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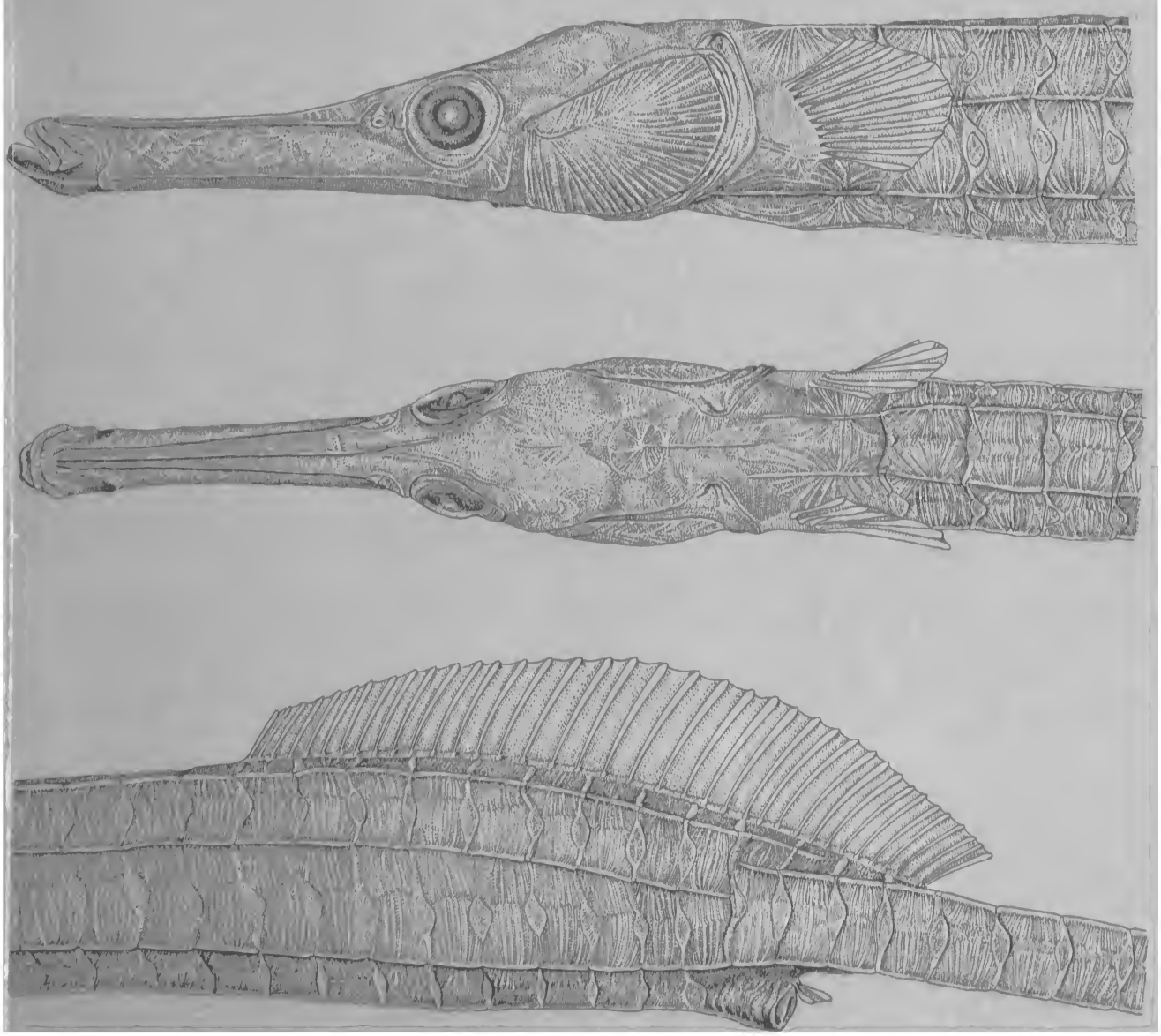

COVER ILLUSTRATION

Mitotichthys tuckeri. Lateral and dorsal aspects of head and anterior trunk rings, together with lateral section of body illustrating configuration of principal ridges and fin positions. From adult female. (Drawn by Nancy Gordon and Yasue Matthews (GCRL)).

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CONTENTS

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INSTRUCTIONS TO AUTHORS

The National Museum of Victoria was established in 1854 for the purpose of scholarship and education in the fields of natural history and anthropology. The Museum publishes two scientific serials to further these objectives, *Memoirs of the National Museum of Victoria* and *Reports of the National Museum of Victoria.*

The *Memoirs* publishes papers on original research in the natural sciences pertinent to Victoria and/or the museum's collections. All contributions are assessed by an independent referee before publication.

The *Reports* are research documents of sufficient importance to be preserved but which are not appropriate for primary scientific publication. Reports are factual rather than interpretive studies, may be of special local interest or may be larger than a normal scientific paper. Contributions will be refereed if appropriate.

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References should be listed alphabetically at the end of the paper. Abbreviations of titles of periodicals must conform with those in *A World List of Scientific Periodicals* (1963-4. 4th ed., London, Butterworth). References to books should give the year of publication, number of edition, city of publication, name of publisher. Titles of books and (abbreviated) names of periodicals should be underlined in the typed list of references.

Acknowledgements are placed at the end of the paper before References.

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DOROPYGUS MIRABILIS, A NEW SPECIES OF NOTODELPHYID (COPEPODA CYCLOPOIDA) FROM BASS STRAIT

By A. David McKinnon

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Abstract

The female of *Doropygus mirabilis*, new species (Copepoda: Notodelphyidae) taken in benthic samples from Bass Strait, Australia, is described.

The genus *Doropygus* comprises some 27 valid species, with a large number of additional indeterminable species. The generic description was emended by Illg (1958), and 15 species reviewed, of which 3 were described by Schellenberg (1922) from New Zealand. Half of the additional 12 species described since 1958 come from Australasia (Gotto, 1975, Jones, 1974, 1979). So far, all *Doropygus* species have been found associated with Tunicata.

During analysis of benthic samples collected by epibentic sled in the Museum of Victoria's Bass Strait Survey a remarkable new form of *Doropygus* was discovered. Unfortunately, due to the collecting techniques employed, no host for the animal is known. The few specimens recovered were loose and retained by the finest sieves used (pore size 1.0 mm) only because of their large size.

Specimens were measured and dissected in glycerol, and mounted on microslides in polyvinyl lactophenol with a trace of chlorazol black E. Drawings were prepared using Wild M5 and Wild M20 phase contrast microscope and camera lucida. Further examination was made with Zeiss and Olympus Nomarski microscopes. Unless otherwise stated, all figures are of the holotype.

Family NOTODELPHYIDAE Dana, 1853

Genus **Doropygus** Thorell, 1859

Doropygus mirabilis, sp. nov.

Figures 1-3

Material examined: 5 ovigerous females collected by epibenthic sled in 74 m, Bass Strait 39°45.9′ S, 145°33.5′ E, Victorian Institute of Marine Sciences Cruise 81-T-1, New Zealand Oceanographic Institute RV Tangaroa, 13.11.81 (Bass Strait Survey Station 156).

Type Material: Holotype female (Reg. No. J3147) and 4 paratype females (J3148-J3149) deposited in Museum of Victoria. Holotype and one paratype (J3148) mounted on slides, with prosome, broodsack and urosome (holotype only) separate in vials.

Description—Female: Body large and globose (Fig. 1a-c), the holotype measuring 1.82× 1.36×1.36 mm. The prosome has 5 somites, comprising the head, 3 thoracic somites and the much enlarged broodsack. The head has no apparent rostrum. The first thoracic somite is reduced (Fig. 1d); the head and thoracic somites measure 1.18 mm long×1.12 mm wide. These somites reflex fully upon the broodsack, their margins fitting closely around a lip produced from the surface of the broodsack. The urosome is contained in a furrow on the broodsack (Fig. 1d) and is 6-segmented (Fig. 2h, i), the first being very closely associated with the broodsack. The urosome is robust and curved to follow the curvature of the broodsack. The furcal rami are 3.5 times as long as wide and bear 4 reduced terminal setae, 1 dorsal seta and 1 lateral seta.

Antennule (Fig. 2a) with 9 segments, bearing respectively 3, 16, 5, 3, 5, 4, 2, 3, 8 setae. Some setae on segments 1 to 7 are plumose.

Antenna (Fig. 2b, c) 3-segmented. Segments 1 and 2 each bear a small seta on the outer margin. Segment 3 bears a strong terminal claw, and proximal to it a group of 3 strong spiniform setae. A single plumose seta arises from the inner margin adjacent to the claw, and 2 setae arise just proximal to the base of it. A further 2 small setae are borne adjacent to the distal outer margin of the segment.

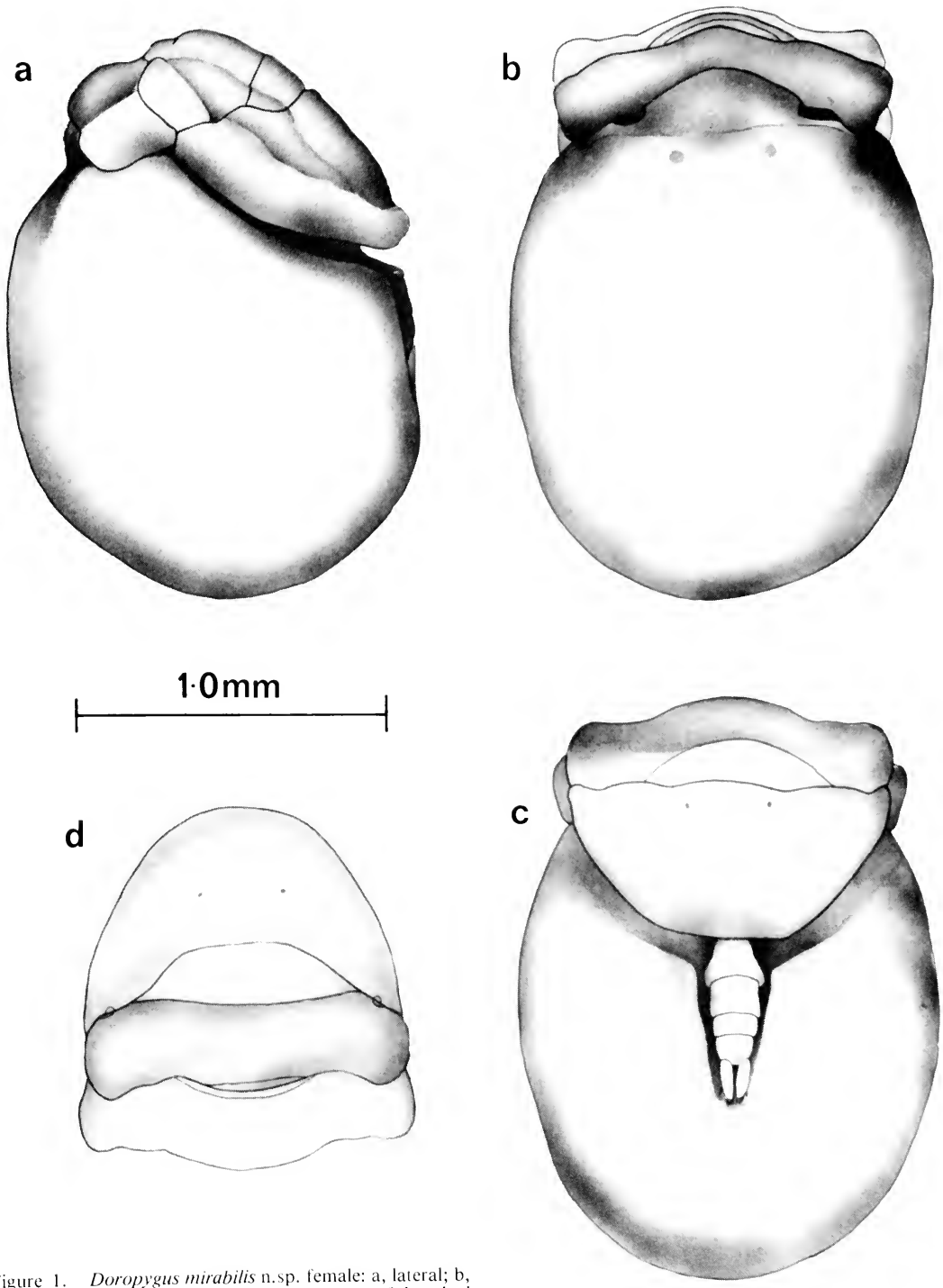


Figure 1. *Doropygus mirabilis* n.sp. female: a, lateral; b, dorsal; c, ventral; d, dorsal aspect of detached head and anterior 3 segments of prosome.

Mandible (Fig. 2d) consisting of a masticatory blade and a biramous palp. The blade bears a single fine tooth on the end most proximal to the palp, then four strong triangular teeth, a weaker tooth, a row of denticles, and 2 setiform elements. The palp has a large basipod armed with one marginal seta. The endopod is bimerous, the basal segment bearing 4, the distal segment bearing 9 setae. The distal segment has numerous small denticles on the outer face. The exopod is unimerous and bears 5 setae, the 5th reduced. All setae on the palp are plumose.

The maxillule (Fig. 2e) has 9 masticatory setae along the medial margin of the proximal endite. A second minor endite bears a single plumose seta. The reduced epipodite bears 2 plumose setae, the more distal of which is much reduced. The apical region of the basipodite bears 3 plumose setae. The exopod is unimerous and bears 4 plumose setae, the endopod unimerous with 3 plumose setae.

The maxilla (Fig. 2f) is pentamerous. The basal segment has 4 medial lobes, with 3, 1, 2 and 2 setae respectively, plus 1 reduced spiniform seta on the 4th lobe. Segment 2 bears 2 setae and a reduced spiniform seta, segments 3 and 4 each bear 1 seta, and the terminal segment bears 4 setae.

The maxilliped (Fig. 2g) is bimerous, the large basal segment bearing 9 robust setae along the medial margin. A small terminal segment bears 2 long plumose setae. Both segments bear a row of setules proximally.

Leg 1 (Fig. 3a) with both endopod and exopod trimerous, legs 2-4 (Fig. 3b, c, d) with the endopod bimerous. Formula for armature as follows (outer margin first; Roman numerals spines, Arabic numerals setae):

Leg 1	coxa 1-1	basis 0-1	exopod I-1; I-1; III-I-4 endopod 0-1; 0-1; 1-2-3
Leg 2	coxa 0-1	basis 1-0	exopod I-1; I-1; 3-2-4 endopod 0-1; 1-3-4
Leg 3	coxa 0-1	basis 1-0	exopod I-1; I-1; 3-1-4 endopod 0-1; 1-3-4
Leg 4	coxa 0-0	basis 1-0	exopod I-1; I-1; 3-1-4 endopod 0-1; 1-3-3

The outer marginal coxopod seta of leg 1 is of peculiar form, with a bladder-like basal portion and a short finely tapering distal portion. Legs 2-4 have a comb of spinules on the coxa. Only leg 1 has outer marginal spines on the exopod; these are replaced by robust naked setae in legs 2-4. Similarly, leg 1 has all setae plumose, whereas in legs 2-4 only the innermost setae of each ramus are plumose.

Leg 5 (Fig. 3e) is bimerous, the basal segment fused to the urosome and bearing a naked outer seta. The terminal segment is 5.5 times as long as wide and bears 2 terminal setae, the outermost of which is 2.6 times as long as the innermost. The inner margin bears a row of spinules and terminally there is a cluster of spinules on the front surface.

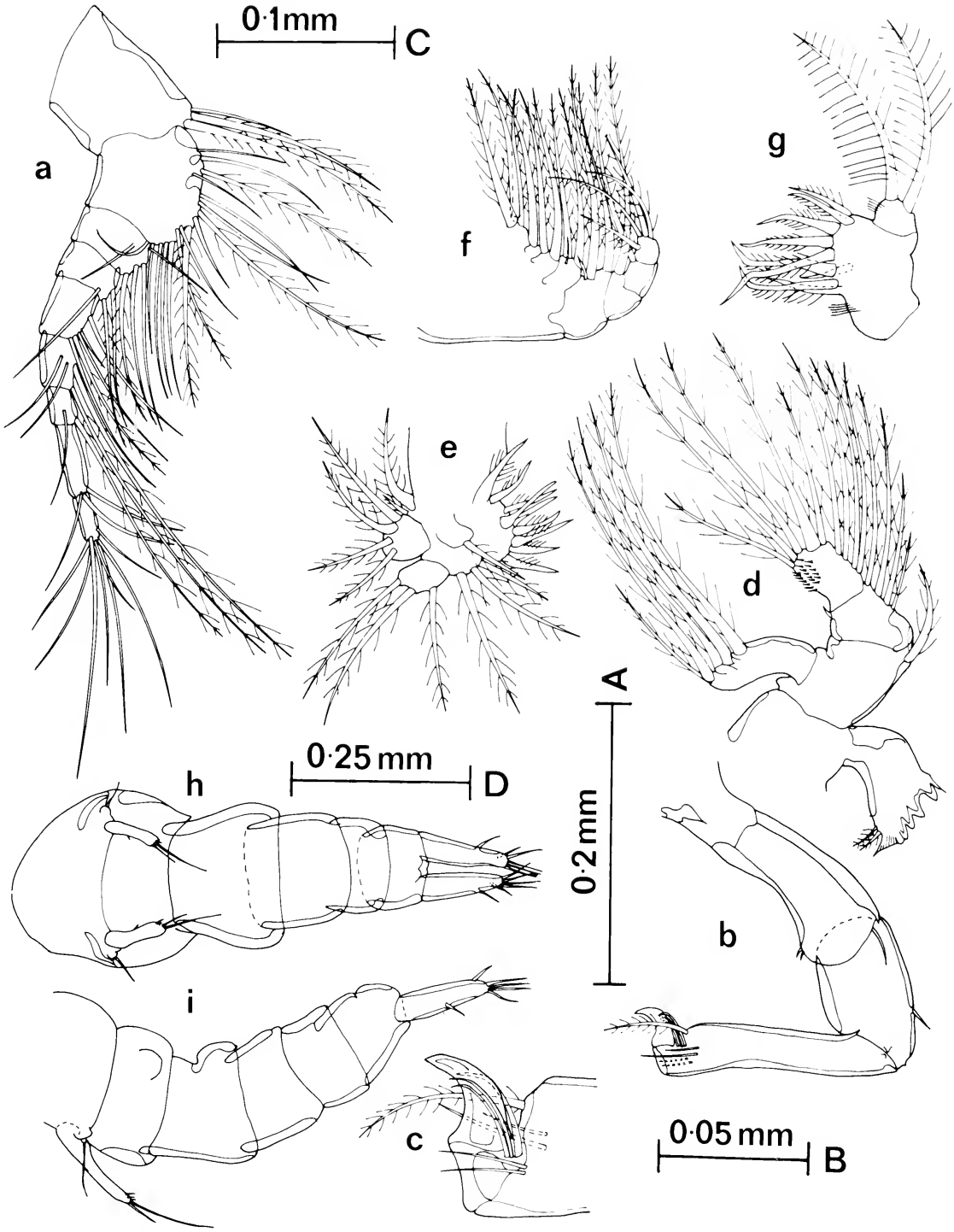
Male: Unknown.

Remarks: *Doropygus mirabilis* does not closely resemble any other species of the genus; its habitus and lack of a rostrum make it unique. It is however allied to *D. rigidus* Ooishi, 1962 and *D. platythorax* Jones, 1974 because it has no hook on the second segment of the maxilla, 4 setae on the exopod and 3 on the endopod of the maxillule and 9 setae on the mandibular endopodite.

Although the complete body of *Doropygus mirabilis* is globose, the prosome excluding the broodsack is dorsoventrally depressed, with the margin of the somites downturned to form a rim. In this respect, *D. mirabilis* carries further the tendency shown in *D. platythorax*, the rim fitting closely over a lip produced from the broodsack. *D. mirabilis* represents an extreme case in the evolution of the genus *Doropygus* in which the prosome reflexes fully upon the broodsack, which in turn has enveloped the urosome.

Figure 2. *Doropygus mirabilis* n.sp. female: a, antennule (scale A); b, left antenna (A); c, terminal region of right antenna (B); d, mandible (A); e, maxillule (C); F, maxilla (C); g, maxilliped (C); h, urosome, ventral (D); i, urosome, lateral (D).

Figure 3. *Doropygus mirabilis* n.sp. female: a, leg 1 (A); b, leg 2 (A); c, leg 3 (A); d, leg 4 (A); e, leg 5 (B), paratype female J3148.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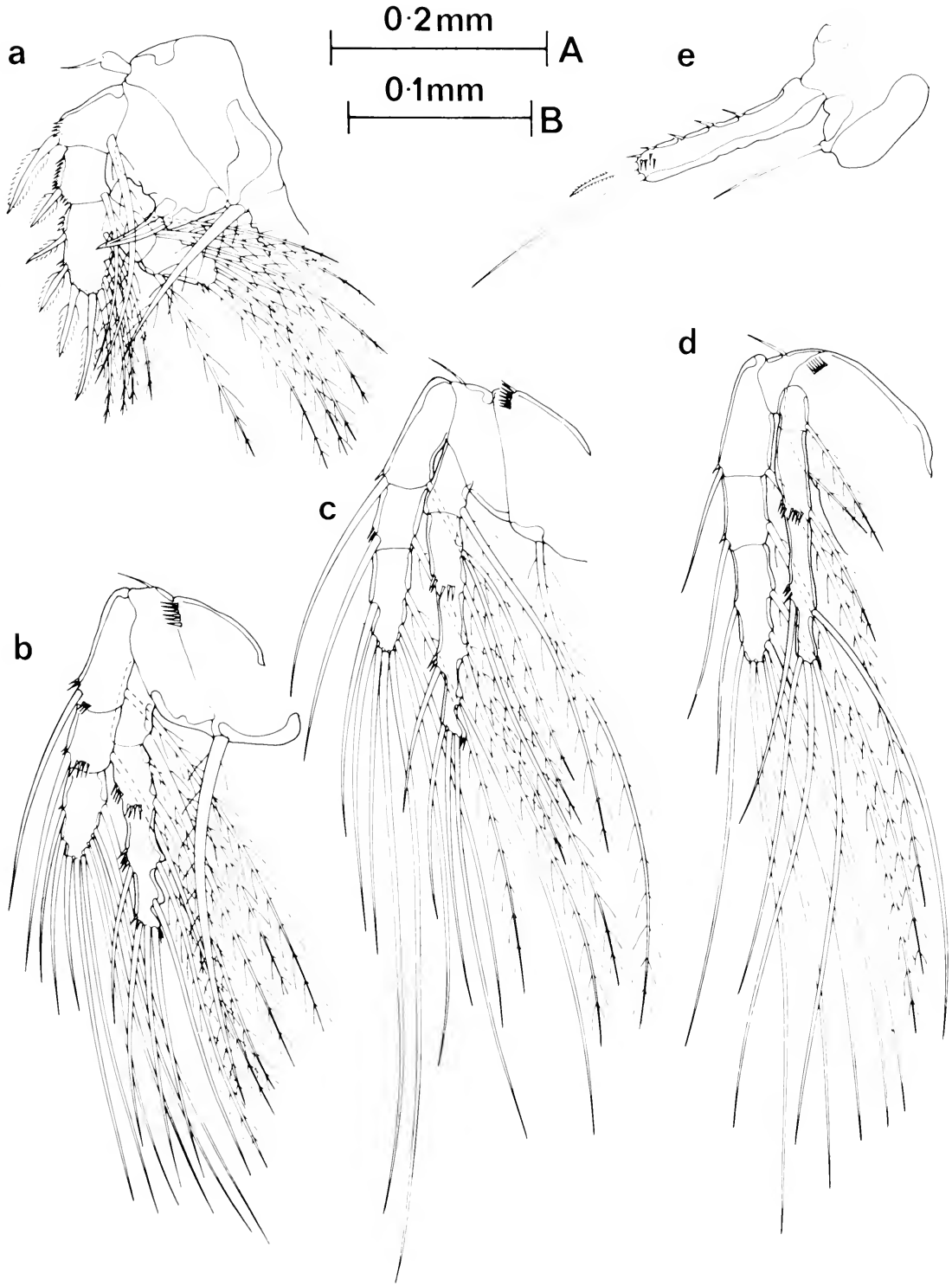
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Acknowledgements

I thank Dr Gary Poore for his help and encouragement at all stages of this study and Dr J. B. Jones and Dr R. Hamond for constructive criticism of the manuscript.

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TWO NEW SPECIES OF TUBULARIAN HYDROIDS FROM SOUTHERN AUSTRALIA

By Jeanette E. Watson

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Abstract

Two new species of tubularian hydroids from southern Australia are described. *Hybocodon cyrptus* is the fourth recorded species of this rare genus, and a first record of the genus from Australia. *Ralpharia coccinea* is the second species of a genus known only from Australia. Notes are given on the ecology of both species and on the reproduction of *R. coccinea*.

Introduction

The new species of tubularian hydroids described in this paper occur in ocean waters and in two embayments of the southern Australian coastline. One is a second species of the formerly monospecific genus *Ralpharia* Watson, 1980: the other belongs to the rare genus *Hybocodon* L. Agassiz, 1862, not previously recorded from Australia.

Ralpharia magnifica Watson, 1980, known only from Australia, was described from shallow water reefs of Western Port, Victoria, growing on an alcyonacean host. A second species, described here, has since been found in Western Port growing on the same species of alcyonacean host as *R. magnifica*, and sometimes in association with it. *Hybocodon* comprises three known species, *H. prolifer* Agassiz, 1862, known from the North and South Atlantic and Pacific Oceans (Russell, 1953), and from New Zealand (Ralph, 1953); *H. unicus* Browne, 1902, recorded from the South Atlantic, Indian and South Africa (Millard, 1975); and *H. chilensis* Hartlaub, 1905, from the Atlantic coast of South America. The first two species of *Hybocodon* are better known from their medusae than from the hydroid stage; *H. chilensis* has been recorded only once, as the hydroid.

Type material of the two new species is lodged in the National Museum of Victoria, Melbourne.

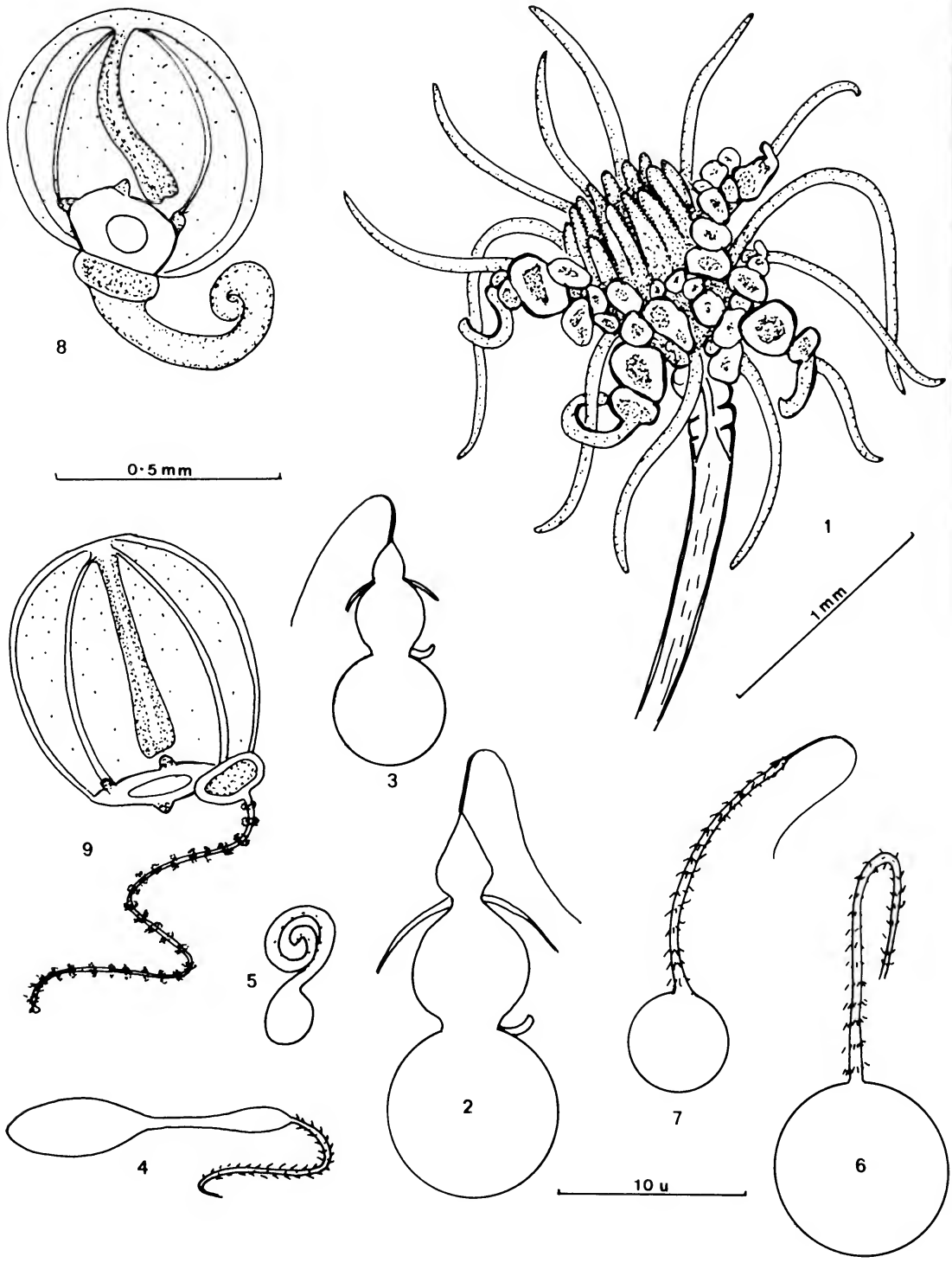
SYSTEMATIC SECTION

Hybocodon Agassiz, 1862

Hybocodon cryptus sp.nov.

Type material: holotype colony. NMVG2601, Coll: J.E. Watson, from reef, 3 km off Portsea, Port Phillip Bay, 15 m deep, 14.7.82. Part of colony preserved in 70% alcohol and part in 5% formalin.

Description from holotype colony: Hydrocauli up to 3 cm high and 0.5 mm diameter below hydranth. Stems solitary, unbranched, erect, sometimes obscurely undulated, narrow proximally, increasing in diameter distally to hydranth. Perisarc firm, thick, transparent, shining, with numerous fine annular growth striae externally, and indistinct internal longitudinal canals, becoming thin, swollen and loosely wrinkled below hydranth. Hydranth terminal, 2 mm long and 6 mm across the extended aboral tentacles (living material). Aboral tentacles 12-18 in number, 2.5 mm long, slender, fragile, with pointed tips. Oral tentacles stubby, 18-30 in two closely set rows surrounding a conical hypostome. Blastostyles erect, branched, 6-8 arising just above aboral tentacles, with several to many clusters of medusa buds in various stages of development. Medusae at liberation almost spherical, about 0.5 mm diameter, with a single tentacle arising from a large bean-shaped marginal bulb; three small triangular marginal bulbs at the bases of the other radial canals. Margin of bell very slightly oblique, velum a wide shelf with a small circular opening. Hypostome long, cylindrical, extending almost to margin, slightly swollen distally, marginal tentacle thick and contracted prior to, and immediately after liberation; at 24 hours after release extending to more than 1 mm, with 15-20 batteries of nematocyts. Nematocysts also scattered over exumbrella surface, more numerous towards top of bell.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Nematocysts of five kinds present in hydranth:

Stenoteles of two sizes in aboral tentacles: (i) small, capsule slightly elongate, 6-7 μ wide, butt 6-7 μ long, very abundant; (ii) capsule spherical, 9-10 μ diameter, butt 11-12 μ long, thread fairly short, abundant.

(iii) Microbasic euryteles, capsule 8 μ long, 3-4 μ wide, butt 8-9 μ long, with long thread, common near tips of aboral tentacles.

(iv) Desmonemes, capsule 3-4 μ long, 2.5-3 μ wide, thread remains loosely coiled on discharge; common in tentacles and body of hydranth.

(v) Heterotrichous anisorhizas, capsule spherical, 8-11 μ diameter, thread very long, thick and heavily barbed, rare in proximal parts of tentacles.

Nematocysts of four kinds present in medusa:

Stenoteles, microbasic euryteles and desmonemes similar to nematocysts (i), (iii) and (iv) of hydranth.

(vi) Microbasic mastigophores, capsule 5-6 μ diameter, butt 13-18 μ long, with very long thread.

Colour: Stems greenish yellow, aboral tentacles transparent, oral tentacles white, body of immature hydranth rose pink, becoming pale yellow with longitudinal stripes at maturity, gonophores pale yellow. Newly liberated medusa transparent, tentacular marginal bulb creamy yellow, other marginal bulbs golden.

Remarks: The hydranth and medusa of *Hybocodon cryptus* are similar to those of *H. unicus*; however *H. cryptus* may be distinguished from that species by the cnidome of the hydroid. The scattered nematocysts on the exumbrella of the medusa of *H. cryptus* clearly distinguish the species from *H. prolifer*. The cnidome of *H. chilensis* is unknown. It is, however, a larger species measuring 6 mm across the tentacles (Hartlaub, 1905), and is known only from the type.

H. cryptus is a common winter hydroid in southern Port Phillip Bay and in the oceanic waters of Bass Strait, growing and reproducing at lowest water temperatures of 10°-12°. It usually grows in sparse clusters of up to 15 well separated stems, growing to 8 cm high from a hydrorhiza deeply embedded in sponge; it occasionally also occurs on old shells. Although sometines growing in open situations, it is a cryptic species whose preferred habitat is in crevices sheltered from strong water movement. The hydranths are readily shed and the stems show evidence of repeated regeneration, possibly due to fish grazing.

Figures 1-9. *Hybocodon cryptus* sp.nov.

Figure 1. Fertile hydranth, drawn from living holotype colony.

Figures 2-6. Nematocysts from hydranth, all drawn to same scale.

Figures 2, 3. Stenoteles. Figure 4. Microbasic eurytele. Figure 5. Desmoneme. Figure 6. Heterotrichous anisorhiza. Figure 7. Microbasic mastigophore from medusa (same scale).

Figure 8. Newly liberated medusa. Figure 9. Spent medusa 24 hours after liberation.

Ralpharia Watson, 1980

Ralpharia coccinea sp. nov.

Type material: holotype colony (male colony), NMVG2602, Coll: J.E. Watson 12.9.82 from reef, Crawfish Rock, Western Port, Victoria, 3 m deep, on the alcyonacean *Parerythropodium membranaceum* Kükenthal. Part of colony preserved in 70% alcohol and part in 5% formalin.

Description from holotype colony: Hydrorhiza tubular, 0.3-0.5 mm diameter, embedded in the alcyonacean substrate. Stems short, robust, to 20 mm long, widening to 0.5-0.8 mm diameter below hydranth. Perisarc thickest proximally, with faint annular striations, thinning distally, becoming a loosely wrinkled sheath below hydranth, coenosarc longitudinally striated. Hydranths variable in size, distinctly separated from stem by a platform-like base. Mature hydranth 5-7 mm across the extended tentacles (living material), aboral tentacles 2 mm long, 20-24 in a single verticil, and 20-24 short oral tentacles in a tuft 2 or 3 deep surrounding an elongate hypostome. Gonophores arising from a wide shelf between the hydranth body and aboral tentacles, 8-10 borne singly on short, un-

branched blastostyles, balloon-shaped, distally truncated, up to 1.5 mm long at maturity, with 4 conspicuous radial canals and circular canal and 4 rudimentary tentacle knobs; without mouth or tentacles at liberation.

Nematocysts of five kinds present on hydranth and gonosphores:

Stenoteles of two sizes: (i) large, capsule spherical, 10-11 μ diameter, common on hydranth body and aboral tentacles, butt 10-12 μ long; (ii) smaller stenoteles, capsule spherical, 5-6 μ diameter, butt 5-6 μ long, very abundant in tentacles and on gonophores.

(iii) Macrobasic mastigophores, capsule subglobose, 12-13 μ long, 8-9 μ wide, thread very long, thick, of same diameter and spinose throughout, spines longer and thicker, near base. Very abundant at base of aboral tentacles and on hydranth body.

(iv) Desmonemes, capsule bean-shaped, 5 μ long, 3 μ wide.

(v) ?Atrichous isorhizas, capsule flask-shaped, 10-12 μ long, 4-5 μ wide, with a short cylindrical neck. When discharged, neck everts into a short thick thread. Moderately common in oral tentacles.

Colour: Stems pale green to brown, coenosarc orange in distal region, tentacles transparent, sometimes with a faint orange longitudinal stripe; hydranths and gonophores brilliant scarlet, radial canals of immature gonophore of a glistening frosted white appearance. Umbrella of liberated medusa clear, radial canals purplish, spadix orange.

Remarks: Ralpharia coccinea is easily recognised by its small size and robust, brilliantly coloured hydranths and gonophores. The extreme difference in size, and certain differences in the cnidome distinguishes this species from its congener, *R. magnifica*. the unusual flask-shaped nematocysts of the hydranth could not be easily discharged, even in living material, and hence these are only provisionally identified as anisorhizas.

A small female colony (not included in the type material) also collected from Crawfish Rock by the author (17.12.78) contained mature gonophores identical in shape to the male and containing about 12 clearly visible ova. Prior to liberation, the gonophores of both sexes pulse spasmodically and the radial canals change from white to a purplish colour. One or two amoeboid processes may protrude from the opening of the female medusa. Release of gonophores occurred at night in the laboratory. The spent female medusae are similar to the male and continue spasmodic pulsing movements for about 12 hours after release. The orange coloured actinulae emerge with 5-7 rudimentary tentacles, and if remaining on the alcyonacean substrate, crawl sluggishly away before settling. The subsequent history of the actinulae was not followed. However, the early stages are so similar to those of *R. magnifica* that there is little doubt that the metamorphosis of *R. coccinea* will follow the same sequence as described for *R. magnifica* (Watson, 1980).

Of considerable ecological interest is the obligate association of the two closely related species with the same alcyonacean substrate. *R. magnifica* grows from the alcyonacean in sparse colonies of up to 20 stems while *R. coccinea* may form colonies of up to 200 hydranths growing close to the alcyonacean surface. The hydrorhizas of the two species are often intergrown through the thin, sheet like alcyonacean. The growth and reproductive seasons of the two species overlap only slightly: *R. magnifica* is a summer hydroid, reproducing at maximum water temperature, whereas *R. coccinea* grows,

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Figures 10-18. *Ralpharia coccinea* sp. nov.

Figure 10. Fertile hydranth, drawn from underwater photograph *in situ* of living specimen from holotype colony.

Figure 11. Developing female gonophore showing amoeboid processes protruding from medusa prior to liberation.

Figure 12. Spent medusa, 8 hours after liberation.

Figures 13-18. Nematocysts, all drawn to same scale. Figure 13. Large stenotele from hydranth. Figure 14. Smaller stenotele from hydranth and gonophore. Figure 15. Macrobasic mastigophore from hydranth. Figure 16. Desmoneme from hydranth. Figure 17. ?Atrichous isorhiza from hydranth, undischarged. Figure 18. Same, discharged.

and is reproductive in the rising temperatures of late winter to spring.

Acknowledgements

I am grateful to the Australian Research Grants Committee for financial support during this study.

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SEROLIS (CRUSTACEA, ISOPODA, SEROLIDAE) FROM AUSTRALIA, WITH A NEW SPECIES FROM VICTORIA

By K. Harrison* and Gary C. B. Poore†

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Abstract

Species of *Serolis* from eastern Australia (except *S. minuta* and related species) are described and figured and a key to distinguish them is presented. These are *Serolis australiensis*, *S. elongata*, *S. levidorsata* sp. nov., *S. longicaudata*, *S. pallida* and *S. tuberculata*.

Introduction

Isopods of the genus *Serolis* Leach, 1818, are common components of the fauna of particulate substrates off the coast of eastern and southern Australia. Eight species have previously been described: *S. tuberculata* Grube, 1875; *S. australiensis* Beddard, 1884; *S. elongata* Beddard, 1884; *S. longicaudata* Beddard, 1884; *S. pallida* Beddard, 1884; *S. minuta* Beddard, 1884; *S. bakeri* Chilton, 1917; and *S. yongei* Hale, 1933.

Little work has been carried out on Australian species and Sheppard's world-wide monograph (1933) and Beddard's (1884b) work remain the standard texts for the identification of these species. Recently, Holdich and Harrison (1980) examined specimens belonging to the *Serolis minuta*-group (a term coined by Monod (1971) to include *S. minuta*, *S. bakeri* and *S. yongei*) and found a marked capability for infraspecific morphological variation. As an extension of this work, specimens of all other Australian species are examined here and an additional species is described.

The material on which this study is based comes from shelf and bay sediments, largely from south-eastern Australia. All specimens have been identified except for numerous poorly preserved juveniles from Western Port (in Museum of Victoria collections) and two problematical series of specimens. These are discussed under *S. australiensis* and *S. pallida* in turn.

Material for this study has come from the following surveys and institutions:

Port Phillip Bay Environmental Study, 1969-1973 (PPBES) carried out in Port Phillip Bay, Victoria, by the Marine Studies Group, Ministry for Conservation, Melbourne, Victoria;

Crib Point Benthic Survey, 1965-1972 (CPBS) and Westernport Bay Environmental Study, 1973-1974 (WBES), both carried out in Western Port, Victoria, by the Marine Studies Group, Ministry for Conservation, Melbourne.

Bass Strait Survey, 1979-1983 (BSS), carried out by the Museum of Victoria with funding from a Marine Sciences and Technologies Grant;

Shelf Benthic Survey, 1973 (AMSBS) carried out on the New South Wales shelf by the Australian Museum, Sydney, N.S.W.;

Three Bays Survey, 1976, carried out near Townsville, Queensland, by James Cook University, Townsville;

'Endeavour' collections, 1914, made on the New South Wales shelf; and other material from the Museum of Victoria, Melbourne (formerly National Museum of Victoria) (NMV); Australian Museum, Sydney (AM); Universitetets Zoologiske Museum, Copenhagen (ZMC); Tasmanian Museum, Hobart (TM); British Museum (Natural History), London (BMNH); and South Australian Museum, Adelaide (SAM).

Specimens not ascribed to a museum have been placed in a collection in the Department of Zoology, University of Nottingham.

The following developmental stages have been recognized: adult male (male with pereopod 2 prehensile, subchelate); subadult

male (stage before adult male, with appendix masculina shorter, and pereopod 2 not prehensile); immature male (stage before subadult male, with appendix masculina visible only as a short extension of the endopod of pleopod 2); ovigerous female (female with brood plates fully formed and overlapping well in the midline); non-ovigerous female (stage before ovigerous female, with small brood plates closely applied to ventral surface and not reaching midline); immature specimen (specimen with all pereopods fully formed, but showing no obvious sexual characters); and post-manca (with seventh pair of pereopods reduced, held horizontally across ventral surface of body).

The scale on all figures is 1 mm.

SYSTEMATICS

Order Isopoda

Infra-order Flabellifera

Family SEROLIDAE

Description: Flabellifera with body markedly dorsoventrally flattened; coxal plates laterally expanded. Pereonite 1 fused with head in midline and enclosing head laterally. Pereonite 7 absent dorsally, or present only as short lateral plates. Pleon with three visible tergites; at least the first narrow, not reaching the lateral margins of the body. Antenna 1 peduncle of four articles. Antenna 2 peduncle of five articles. Each mandible with three-articled palp. Mandibles lacking molar processes; incisor processes well formed, each with two internal subterminal movable spines. Maxilla 1 with inner lobe reduced, outer lobe bearing long stout spines. Maxilla 2 usually with three (occasionally two) spiniferous lobes. Maxilliped broad with a short three-articled palp. Pereopod 1 of both sexes subchelate with dilated ovate propodus bearing inferior rows of setae. Pereopods 3 to 7 ambulatory. Pleonal sternites 1 to 3 each with a small subrectangular plate in midline. Pleopods 1 to 3 each with an elongate basis and sub-elliptical rami; rami bearing long marginal plumose setae. Exopod of pleopod 4 indurate, operculate, covering endopod and pleopod 5 which are respiratory. Uropods usually biramous (occasionally uniramous). Sexual dimorphism not pronounced.

Adult male. Pereopod 2 subchelate, smaller than pereopod 1. Pereopod 7 may bear a reflexed dactylus. Penes absent. Endopod of pleopod 2 bearing a long narrow appendix masculina.

Ovigerous female. Maxillipedal endite may be expanded; other mouthparts not metamorphosed. Pereopod 2 ambulatory. Brood pouch formed from four pairs of brood plates, arising from pereopods 1 to 4 and overlapping well in the midline.

Remarks: The family Serolidae contains four genera: *Serolis* Leach, 1818; *Glabroserolis* Menzies, 1962; *Ceratoserolis* Cals, 1977; and *Atlantoserolis* Cals, 1982.

Glabroserolis was erected to contain Menzies' new species *G. specialis* from the South Atlantic, and was defined as "Serolidae with uniramous uropoda. Coxal plates not marked off on any peraeonal somite. First antenna one-half the width of expanded peduncular article of second. Second article of maxillipedal palp quadrate, not cordate. Basipodites of pleopods 1 to 3 with projecting setiferous inner proximal angles."

Uniramous uropoda are also shown by some species of *Serolis* (e.g., *S. beddardi* Calman; *S. latifrons* Miers); expanded antennal peduncles are shown by *S. pallida*; maxillipedal palp article 2 varies in shape within the genus *Serolis*, many Australian species having this article curved, not cordate; and most non-Australian species have the bases of pleopods 1 to 3 with setiferous extensions. Menzies did not mention pleonal tergites 2 and 3 which are reduced in *G. specialis* and do not reach the lateral margins of the body. This reduction, however, is present to some extent in *Serolis orbiculata* Sheppard.

The only character shown by *Glabroserolis* not shown by typical species of *Serolis* is the lack of sutures separating the coxal plates from the thoracic tergites, but as the number of these sutures varies in the genus *Serolis*, it is not felt here that this character is sufficient to warrant full generic status. The authors feel that *Glabroserolis* should be considered a junior synonym of *Serolis*.

Ceratoserolis was very briefly diagnosed

(Cals, 1977: 2273-6) and was erected to include the Antarctic species: *Serolis trilobitoides* (Eights); *S. cornuta* Studer; and *S. pasternaki* Kussakin. Cals did not contrast *Ceratoserolis* with *Serolis* sensu stricto and the present authors can offer no opinion on the status of this genus. Similarly, *Atlantoserolis* for *S. vemae* Menzies and *S. menziesi* Hessler differs from other serolids in only minor characters.

All Australian serolids are species of *Serolis* and can be separated from all other Australian isopods by use of the family description.

(But see note added in proof.)

Serolis Leach, 1818

Serolis Leach, 1818: 339, 340.
Brongniartia Eights, 1833, 53
Glabroserolis Menzies, 1962: 189

All Australian species of *Serolis* have pereonite 7 absent dorsally, the tergite of pereonite 6 fused with pleonite 1 in the midline, and the bases of pleopods 1 to 3 simple, lacking the proximal acute setiferous extension shown by most non-Australian species. Monod (1971) separated three species (*S. minuta, S. bakeri* and *S. yongei*) from the rest of the species of the Australian fauna. Holdich and Harrison (1980) discussed variation in this "*minuta*-group" and they are not discussed further in this contribution. Characters separating the "*minuta*-group" from other Australian species are given in Table 1.

Key to Australian Species of *Serolis*

1. Pleonal sternites 1-3 not markedly keeled ..... *S. minuta*—group (see Holdich and Harrison, 1980)
- Pleonal sternites 1-3 markedly keeled (e.g., fig. 1g, h) 2
2. Pereon and pleon dorsally smooth, lacking obvious tuberculation (except perhaps in midline) 3
- Pereon and pleon bearing obvious dorsal tuberculation (in addition to the midline) ... 6
3. Midline with pronounced slender dorsal tubercles; antenna 2 peduncle markedly flattened, expanded, greater than twice width of antenna 1 peduncle; uropodal exopod apically emarginate ..... *S. pallida*
Midline at most slightly carinate; antenna 2 peduncle less than twice width of antenna 1 peduncle; uropodal exopod apically truncate or arcuate 4
4. Pleotelson subtriangular, tapering from anterolateral angles; uropods originating in anterior half ..... *S. levidorsata*
- Pleotelson tapering from midpoint of lateral margins; uropods originating in posterior half 5
5. Head with median tubercle; pereon and pleon medially carinate; uropods not reaching pleotelsonic apex ..... *Serolis* sp.
— Head lacking tubercles; pereon and pleon either lacking any indication of median keel, or with weak median keel; uropods reaching pleotelsonic apex ..... *S. longicaudata*
6. Dorsal surface bearing short fine setae (at least some on pleotelson and coxal plates); uropodal exopod apically emarginate ..... *S. tuberculata*
- Dorsal surface lacking setae; uropodal exopod apically truncate 7
7. Dorsal midline with pronounced slender tubercles; pleotelson with well-produced dorsolateral spines ..... *S. elongata*
— Dorsal midline with low weakly produced tubercles; pleotelson with no obvious dorsolateral spines ..... *S. australiensis*

Serolis australiensis Beddard

Figures 1, 2

Serolis australiensis Beddard, 1884a: 330, 334, 335.—1884b: 10, 15, 31, 66, 68-72, 81, pl. 6.—Chilton, 1917: 393, 394, 396, 397.—Hale, 1929: 307-9.—Nordenstam, 1933: 16, 17, 45, 47.—Sheppard, 1933: 256, 265, 268-71, 281, 353, 356-8.—Monod, 1971: 332.—Holdich & Harrison, 1980: 373, 384.

S. australienses (sic.).—Nordenstam, 1933: 39.

Serolis (Heteroserolis) australiensis.—Nordenstam, 1933: 90-2.

Material examined: 58 specimens (4 ovigerous females in Mar. and Apr.) as follows:

SA, No locality, SAM C388(1).

Vic., Port Phillip Bay, off Kororoit Creek, 4.5 m, NMV (1). Hobsons Bay, NMV J1502(1). Western Port: 9 m, sand, WBES stn 1722, NMV J1422(1), NMV J1423(1); 2-19 m, mud,

TABLE 1
A comparison of the two groups of Australian serolids.

minuta-group	other species
1. Pleonal sternites 1 to 3 not markedly keeled; sternite 1 lacking median posterior projection	– Pleonal sternites 1 to 3 markedly keeled; sternite 1, especially, with keel extending posteriorly to overlap sternite 2
2. Pereonite 5, in dorsal midline, usually longer than half length of pereonite 4	– Pereonite 5, in dorsal midline, less than one-third length of pereonite 4, or absent
3. Left mandible with distal, subterminal spine as a broad serrate blade, at least two-thirds width of incisor edge	– Left mandible with distal, subterminal spine not forming a broad blade, less than one third width of incisor edge
4. Carpus of pereopod 1 with an obvious tuft of setae in addition to the two spines	– Carpus of pereopod 1 lacking tuft of setae, at most with several short obscure setae and two spines
5. Propodus of pereopod 1 with a lateral row of long spines in addition to two rows of flattened setae along cutting edge	– Propodus of pereopod 1 lacking lateral row of long spines; with two rows of flattened setae along cutting edge only
6. Coxal plates of pereonite 5 may be partially or completely separated from tergite by sutures	– Coxal plates of pereonite 5 never separated from tergite by sutures
7. Head bearing 1, 3 or 5 posterior tubercles	– Head without tubercles or, at most, one posterior tubercle
8. Article 2 of maxillipedal palp with lateral margin slightly concave proximally; article broadening distally	– Article 2 of maxillipedal palp with lateral margin markedly concave, subparallel to setiferous mesial margin
9. Proximal articles of pereopod 2 of adult male lacking spines; merus and carpus bearing long inferior plumose setae	– Proximal articles of pereopod 2 of adult male bearing spines, lacking plumose setae

sand and shell sediments: 34 specimens from 21 CPBS stations, NMV J1401-21;

Bass Strait, eastern and western Bass Strait, 6-124 m, sandy and shelly sediments, 14 specimens from 9 BSS stations, NMV J1503-6, J2986-90. Off East Moncoeur Is., "Challenger" stn 162, BMNH (3 types).

Tas., Frederick Henry Bay, J. R. Penprase, 16 Aug. 1971, TM G1351(1). Spring Beach (nr Orford), 20 m, A.J. Dartnall, 9 Jun. 1977, TM(1).

Description: Body outline broad, ovate; coxal plates of pereonites 2 to 6 curved, apices acute, closely applied, not freely projecting. Coxal plates of pereonites 2 to 4 separated from tergites by sutures. Head with one low, posterior tubercle. Pereonites 1 to 4 each bearing a long low median tubercle. Dorsal surface of entire body bearing small tubercles weakly developed in some specimens. In the dorsal midline, the posterior margin of pereonite 5 may be fused completely with pleonite 1; marked posteriorly only by a shallow groove; or may be completely distinct from pleonite 1. Pleonal tergites each with a long low median tubercle; pleonites 2 and 3 wider than pleotelson, margins rounded. Pleotelson broader than long, with a median longitudinal carina and, either side of midline, a tuberculate transverse ridge terminating laterally as a low obscure tubercle. Pleonal sternites with pronounced exensions, that of pleonite 1 extending just beyond apex of that of pleonite 2 and not bearing a longitudinal groove.

Antenna 1 extending to pereonite 4. Antenna 2 slender, peduncle not flattened, extending to pereonite 3. Uropodal endopod extending to level of pleotelsonic tip, apex acute; exopod two-thirds length of endopod, apex broadly truncate.

Adult male. Propodus of pereopod 2 broad proximally and tapering distally with the posterior margin bearing two rows of spines along most of its length (Table 2).

Distribution: SA, Vic., eastern Tas., Bass Strait; shelf and bays (type-locality: Bass Strait).

Remarks: The size and distribution of dorsal tubercles varies greatly within this species (Fig. 2). Less tuberculate forms are similar to *S. elongata* but in *S. australiensis* the large median tergal and lateral pleotelsonic tubercles are less pronounced, and the overall body shape is less elongate.

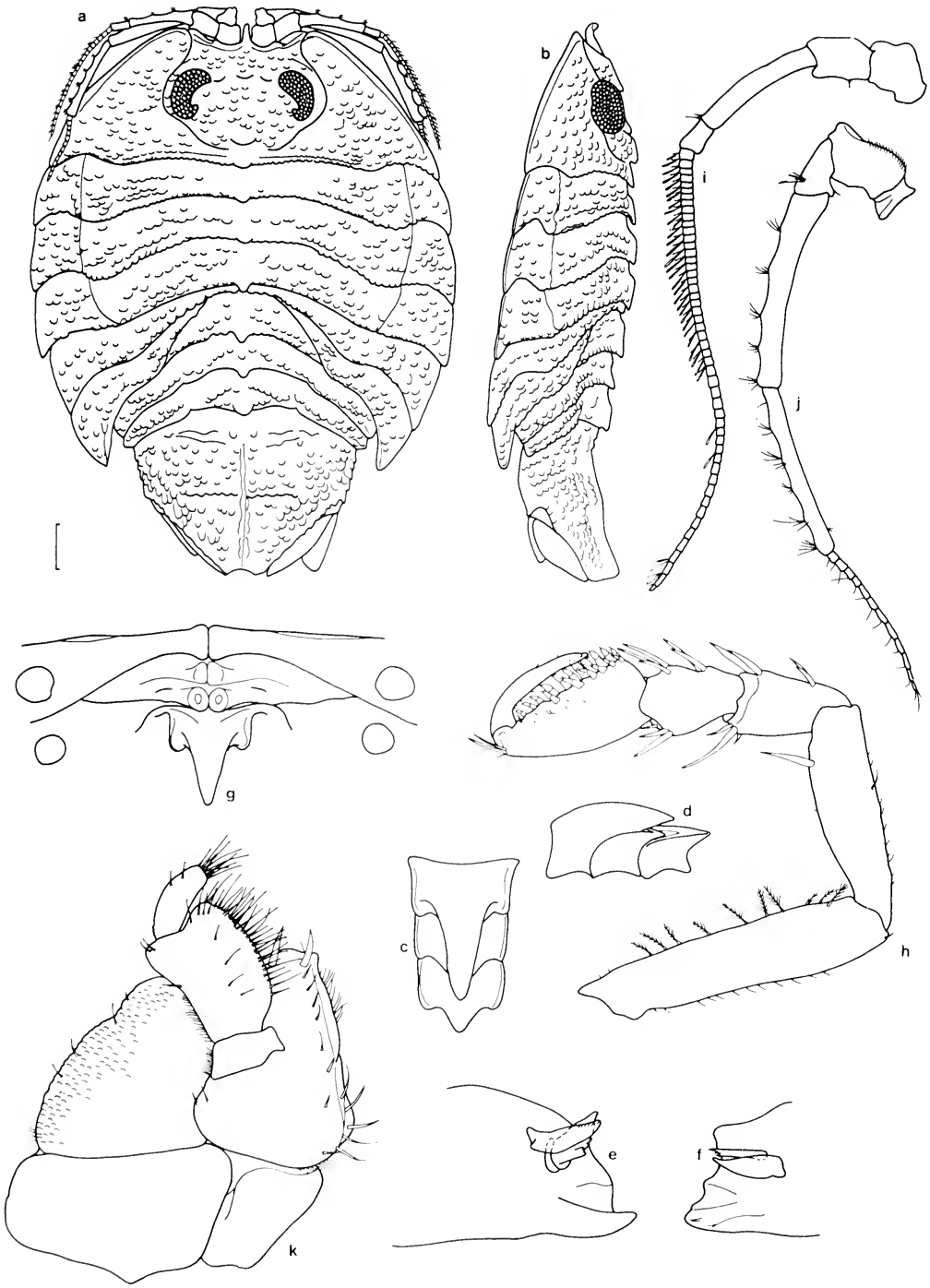


Figure 1. *Serolis australiensis*, Western Port. Ovigerous female (NMV J1408): a, b, dorsal and lateral views; c, d, pleonal sternites; e, f, left and right mandibles. Adult male (NMV J1406): g, posterior pereonal sternites; h, pereopod 2. Adult male (NMV J1407): i, j, antennae 1, 2; k, maxilliped.

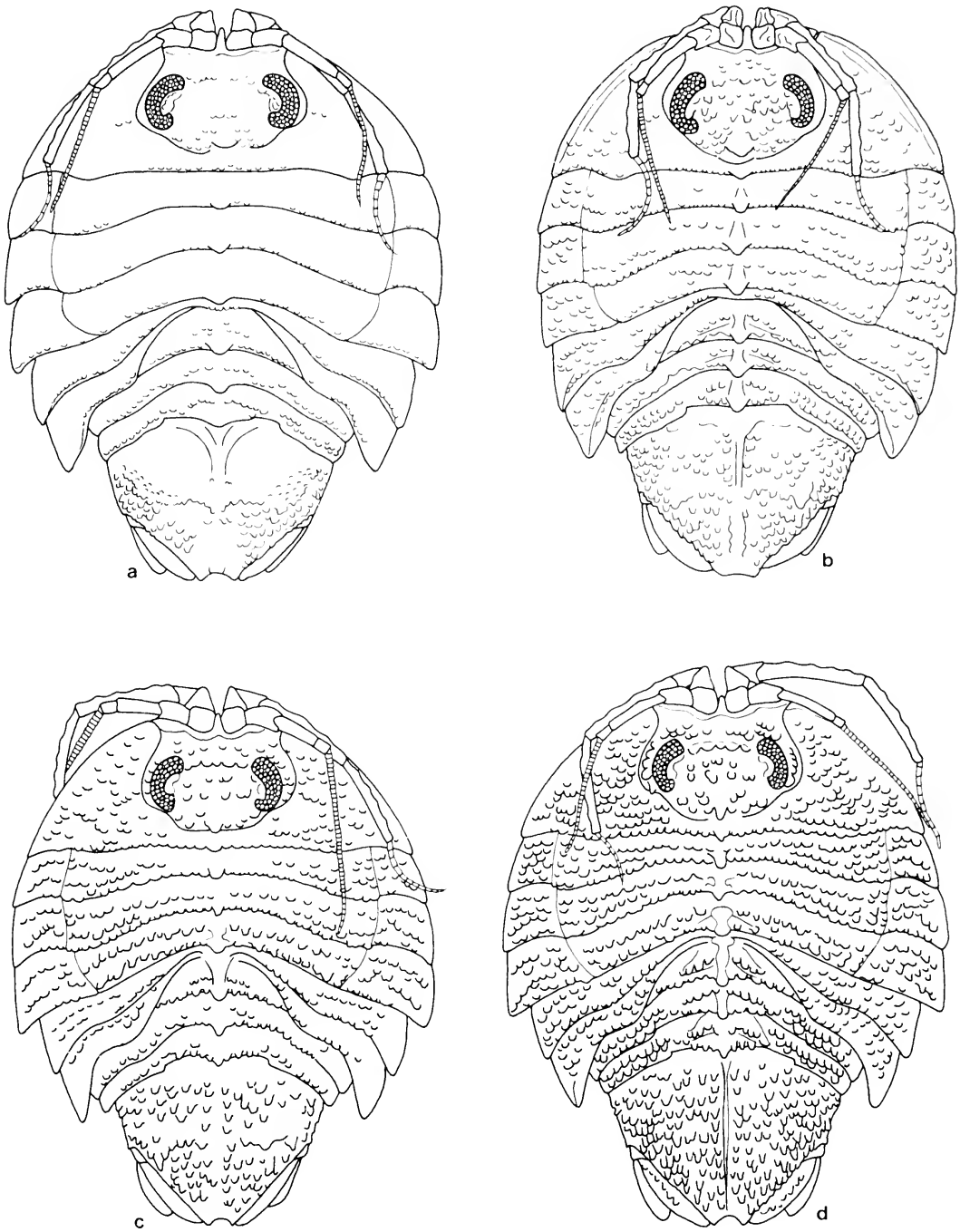


Figure 2. *Serolis australiensis*. a, non-ovigerous female, Port Phillip Bay (NMV J1502). b, ovigerous female, Western Port (NMV J1407). c, subadult male, Western Port (NMV J1401). d, non-ovigerous female, Western Port (NMV J1423).

TABLE 2
Number of spines on propodus of pereopod 2 of adult males of Australian species of *Serolis*. n is number of individuals examined.

	n	Left pereopod		Right pereopod	
		Anterior row	Posterior row	Anterior row	Posterior row
S. australiensis	7	6-9	4-6	8-10	4-6
S. elongata	9	4-8	3-5	4-8	3-5
S. levidorsata	1	6	8	5	6
S. longicaudata	1	5	3	5	4
S. pallida	2	5	6	5	6
S. tuberculata	9	5-8	4-5	6-8	4-6
S. minuta-group	23	2-5	2-6	2-6	2-6

Four specimens from the Australian Museum collections off Sydney and Newcastle key to *S. australiensis*. One of these is the male referred to by Whitelegge (1901) as *S. tuberculata*. These are outside the distributional range of the remaining material and differ in a few minor characters—more elongate first pleonal sternite, more elongate sixth coxal plate and longer antenna 1 flagellum. Their identity remains undecided.

Whitelegge (1901) recorded a single female of *S. australiensis* from off Botany Bay ("Thetis" stn 36) but no specimen from this locality exists in the Australian Museum. However, two specimens labelled Cape Three Points (stn 9) are registered (AM G2199 and P32612). The first of these, a female, is one of the four specimens mentioned above, the second a male, belongs to *S. elongata*. It seems possible that this additional "Thetis" material was not examined by Whitelegge.

Serolis elongata Beddard

Figure 3

Serolis elongata Beddard, 1884a: 330, 335.—1884b: 31, 66, 71, 72, 81.—Whitelegge, 1901: 204, 237.—Chilton, 1917: 393, 394.—Sheppard, 1933: 330-332.—Holdich & Harrison, 1980: 373, 380, 383, 384.

Serolis yongei.—Monod, 1971: 327-31, figs. 4-8. (not Hale, 1933).

Material examined: 104 specimens (ovigerous females in Feb., Apr., Sep. and Oct.):

Vic., Western Port, 5-14 m, mud, sand and shell sediments: 6 specimens from 4 CPBS stations, NMV J1517-20.

Bass Strait, off Cape Everard (Point Hicks), 164-273 m, SAM E6160(1). Flinders Canyon, N. of Flinders Island, 73-329 m, sandy sediments: 4 specimens from 3 BSS stations, NMV J1521-3. Eastern Bass Strait, 58-140 m, sandy sediments: 20 specimens from 5 BSS stations NMV J2981-5.

NSW, off Twofold Bay (37°05′S, 150°05′E) "Endeavour" collection, 30 Sep. 1914: 55-91 m, ZMC (13 specimens); 70-100 m, ZMC(6). Ulladulla, 75 m, K. Sheard, 7 Jun. 1944, SAM TC3624(1). Disaster Bay, "Endeavour" collection, 1 Oct. 1914, 55-73 m, sand and mud, ZMC(1). Port Jackson, 55 m, "Challenger" collection: BMNH 1889.4.27.33 (holotype). Off Port Jackson Heads, "Challenger" collection: NMV J1516(4). Off Cape Three Points, "Thetis" collections, 25 Feb. 1898: 40 m, AM P32612(1); 75-91 m, AM G2284(1). E. of Malabar, 32-83 m: 40 specimens from 5 AMSBS stations, AM P22756-66, P22768-71.

Qld, off Brisbane, fine gravel, 136 m, "Nimbus" collection, 28 Jul. 1968: AM P20194(2), AM P20195(3).

Description: Body outline elongate, ovate. Coxal plates of pereonites 2 to 6 short, apices acute, closely applied. Coxal plates of pereonites 2 to 4 separated from tergites by sutures. Head with one prominent posterior tubercle. Pereonite 1 with short median tubercle, pereonites 2 to 4 each bearing a pronounced acute median tubercle and weak transverse tuberculation. In the dorsal midline pereonite 5 may be: fused completely with pleonite 1; marked posteriorly only by a shallow groove: or may be completely distinct from pleonite 1. Pleonal tergites each with a prominent acute

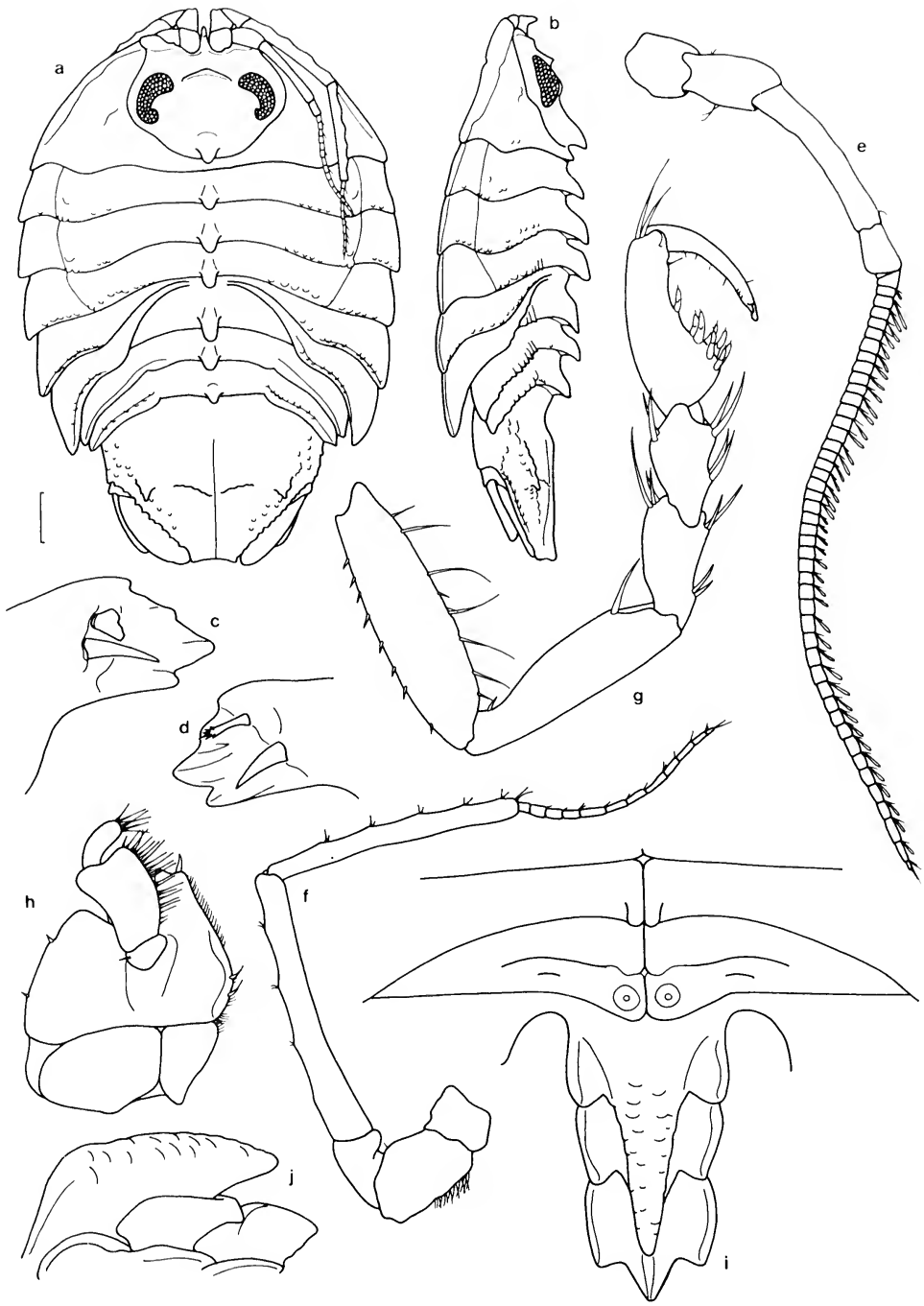


Figure 3. *Serolis elongata*, off Port Jackson. Ovigerous female (NMV J1516): a, b, dorsal and lateral views; c, d, left and right mandibles. Adult male (NMV J1516): e, f, antennae 1, 2; g, pereopod 2; h, maxilliped; i, posterior pereonal and pleonal sternites; j, pleonal sternites.

median tubercle; lateral margins of pleonites 2 and 3 not extended. Pleotelson broader than long with a low median carina and, either side of midline, an obscure median transverse ridge terminating laterally as a prominent acute tubercle. Pleotelson with lateral acute submarginal tubercles. Pleonal sternites with pronounced extensions, that of pleonite 1 extending beyond apex of that of pleonite 2 and not bearing a longitudinal groove.

Antenna 1 extending to pereonite 3. Antenna 2 slender, peduncle not flattened, extending to pereonite 4. Uropodal endopod extending to level of pleotelsonic tip, apex broadly rounded: exopod two-thirds length of endopod, apex broadly truncate.

Adult male. Propodus of pereopod 2 is proximally dilated and distally slender, the proximal bulge bearing two rows of spines (Table 2).

Distribution: Eastern Vic., Bass Strait, NSW and southern Qld (type-locality: Port Jackson, NSW).

Remarks: Slight variation in dorsal tuberculation occurs in this species, with some specimens having irregular transverse ridges on the thoracic tergites while others bear rows of small tubercles. Whitelegge's specimen (Whitelegge, 1901: 237; Holdich and Harrison, 1980: 383, 384) is an ovigerous female of this species (not male as previously reported) and bears extensive, fine tuberculation.

Monod (1971) recorded two specimens from off Moreton Island as *Serolis yongei* Hale. By applying the criteria of Table 1 it was discovered that these specimens do not belong in the *Serolis-minuta*-group and are probably immature specimens of *Serolis elongata* (with which they were found).

Serolis levidorsata sp. nov.

Figures 4, 5

Material examined: Holotype, adult male, 8.7 mm, NMV J1483. Vic., Crib Point, Western Port (38°20.83′S, 145°13.49′E), 13 m, sandy gravel, 25 Aug. 1966 (CPBS station 32N).

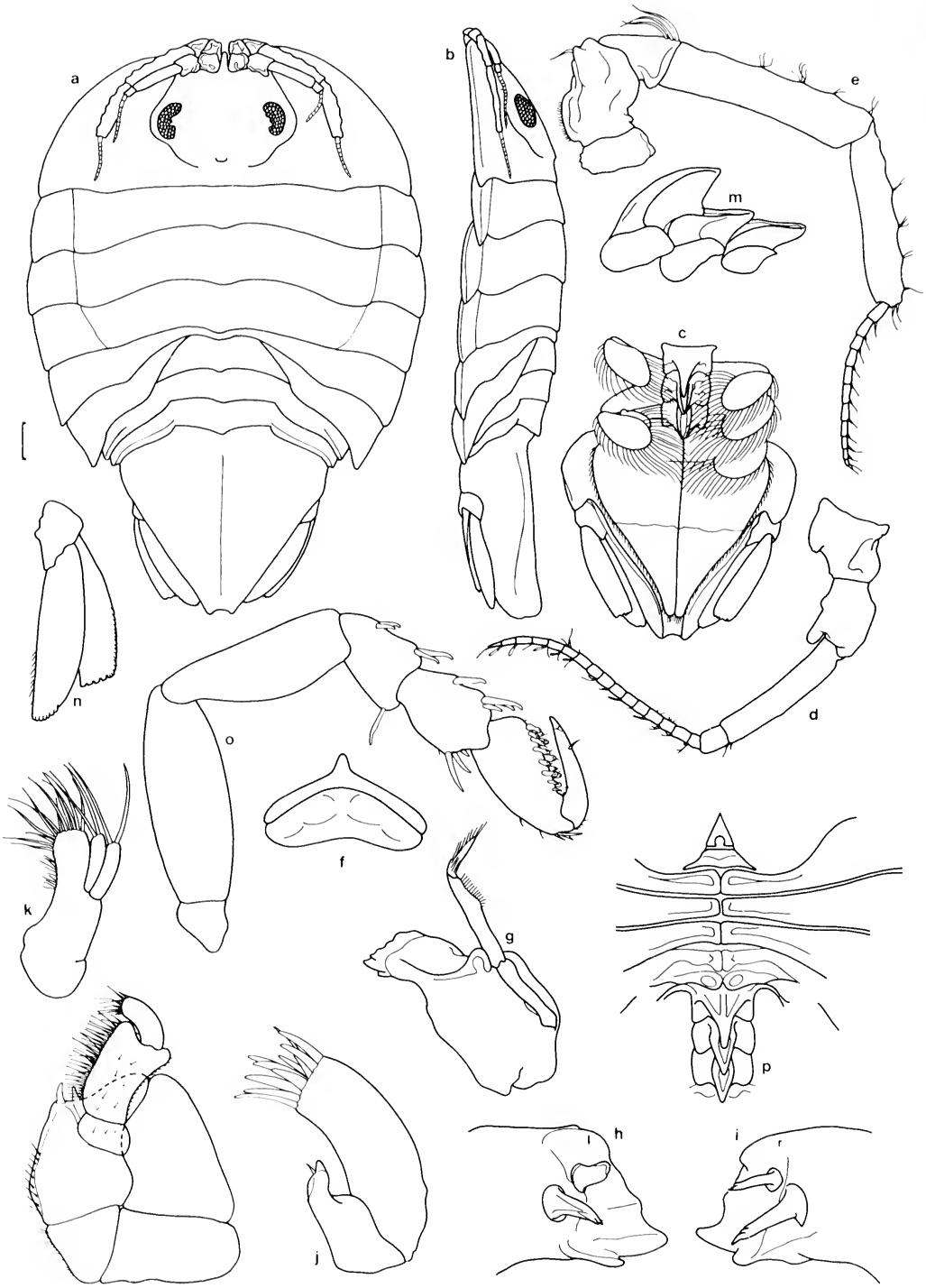
Paratypes: Vic., Port Phillip Heads, J.H. Gatcliff, Dec. 1901, NMV J1493 (1 ovigerous female, allotype, 15.4 mm). Western Port, C. J. Gabriel, NMV J1484 (1 ovigerous female). Crib Point, 14 m, Aug. 1970 (CPBS stn 32S), NMV J1494 (1 ovigerous female). Crib Point, 13 m, Mar. 1965 (CPBS stn 32N), NMV J1495 (2 post-mancae).

Description: Adult male. Body outline elongate, ovate; coxal plates of peronites 1 to 6 closely applied with little or no free projection. Coxal plates of pereonites 2 to 4 separated from tergites by sutures. Head lacking an obvious tubercle. Dorsal surface of body lacking tuberculation but having a weak median keel. In the dorsal midline pereonite 5 is distinct from pleonite 1. Lateral margins of pleonites 2 and 3 not extended. Pleotelson subtriangular, just broader than long, with a deep ventral groove at the apex. Pleonal sternites with pronounced extensions, that of pleonite 1 strongly ventrally lobed, extending half way to apex of second pleonal sternite and not bearing a longitudinal groove. (Mouthparts of male not dissected).

Antennae slender, peduncular articles 1 and 2 sculptured. Antenna 1 with 26-articled flagellum just longer than peduncle, extending to posterior margin of pereonite 2. Antenna 2 peduncle with anterior margins of articles 4 and 5 weakly crenulate: 11-articled flagellum subequal in length to peduncle article 5 and extending to middle of pereonite 2. Pereopod 2 propodus broad proximally, tapering gradually distally, palm bearing two rows of short spines along most of posterior margin (Table 2). Pereopods 3 to 7 ambulatory, spinose, lacking setae except for one or two superior proximal setae on the bases of pereopods 3 to 5. Pleopods 1 to 3 with subelliptical rami, exopods almost twice as long as endopods. Appendix masculina extending to pleotelsonic apex. Exopod of pleopod 4 with transverse suture near midpoint. Uropod with both rami narrow; endopod with apex narrowly rounded, extending almost to level of pleotelsonic apex; exopod reaching three-quarters along length of endopod, apex truncate, bearing slight indentation.

Colour in alcohol. Cream, lacking chromatophores.

Ovigerous female. Differs from male in its larger size, in the primary sexual characters and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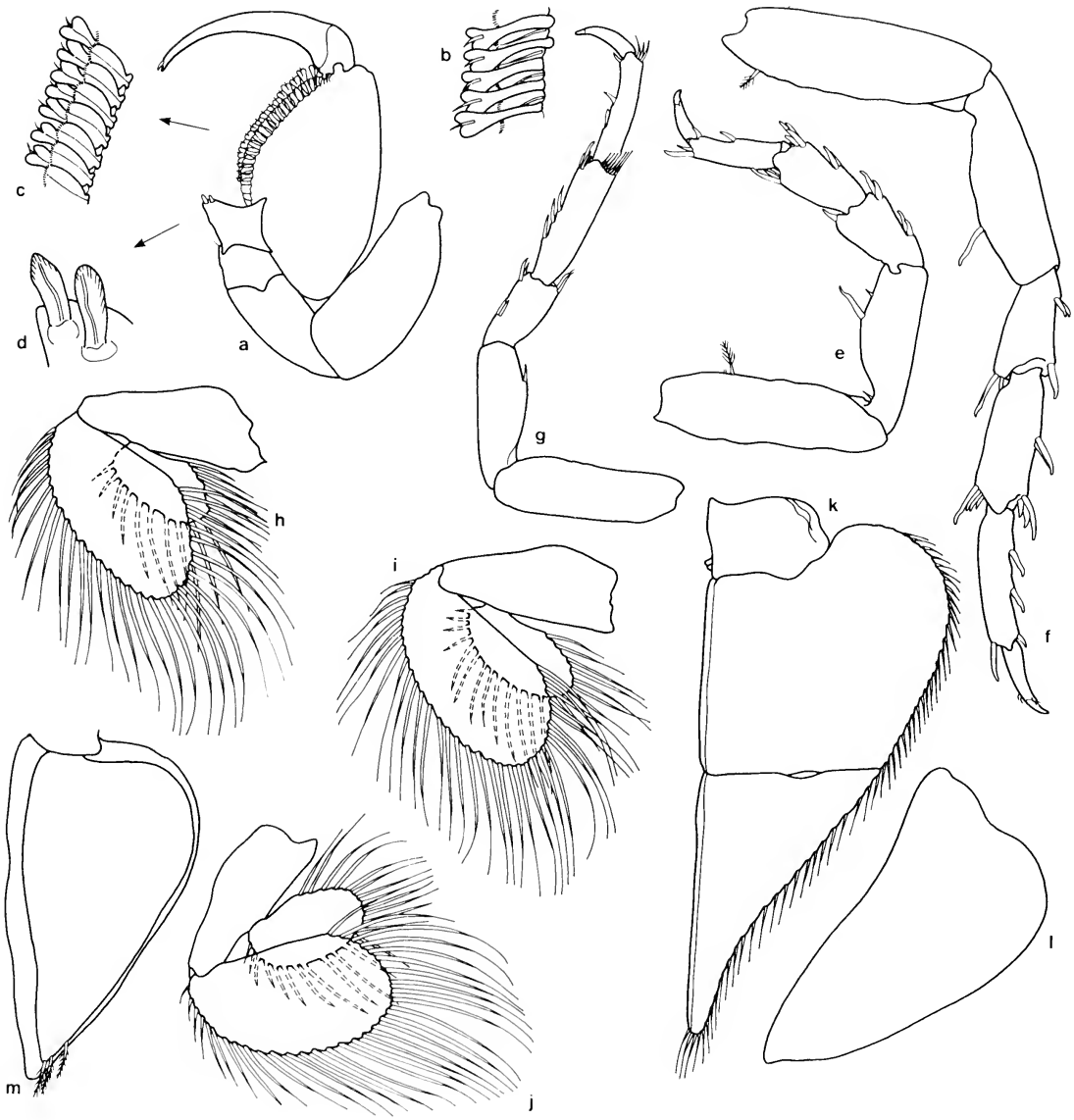

Figure 4. *Serolis levidorsata*, Port Phillip Heads. Ovigerous female (NMV J1493): a, b, dorsal and lateral views. c, pleon and pleotelson. Western Port, ovigerous female (NMV J1484): d, e, antennae 1, 2; f, epistome and labrum; g, left mandible; h, i, left and right mandibles; j, k, maxillae 1, 2; l, maxilliped; m, pleonal sternites; n, uropod. Adult male, Western Port (NMV J1483): o, pereopod 2; p, pereonal and pleonal sternites.

Figure 5. *Serolis levidorsata*, Western Port. Ovigerous female (NMV J1484): a, pereopod 1; b, c, mesial and lateral setae of pereopod 1 carpus; e, f, g, pereopods 2, 4 and 7; h-j, pleopods 1-3; k, l, exopod and endopod of pleopod 4; m, pleopod 5.

in having the antenna 1 flagellum shorter than the peduncle, of 17 articles.

Mouthparts. Left mandible with incisor teeth less pronounced than those of right mandible and anterior movable spine short, broad and blunt; right mandible with anterior movable spine long, slender and acute, with subapical notch. Both mandibles with posterior movable spines stout with acute weakly serrate apices. Mandibular palps well developed, articles 1 and 3 subequal, elongate, extending to incisor edge; article 3 half length of article 2; articles 2 and 3 bearing short inferior setae. Maxilla 1 inner lobe short, acute, with one subterminal spine; outer lobe curved, with 11 simple stout terminal spines. Maxilla 2 outer lobes each bearing two long simple setae; inner lobe with 12 terminal setae and a row of fine internal setae. Maxilliped divided into four plates; basis with two stout simple terminal spines and proximal marginal setae. Maxillipedal palp with article 1 short; article 2 curved, twice as long as broad, with internal margin setose; article 3 reniform, half length of article 2, terminally setose.

Etymology: Latin *levis* + *dorsum*, i.e. smooth + back.

Distribution: Vic. (type-locality: Western Port).

Remarks: In overall body shape and lack of dorsal ornamentation *Serolis levidorsata* resembles *S. convexa* Cunningham (from Argentina and the Falkland Islands), *S. gaudichaudii* Audouin & Milne-Edwards (from South America) and *S. laevis* Richardson (from the South Sandwich Islands), three closely related species. *Serolis levidorsata* differs however in having pereonite 6 fused with pleonite 1 in the dorsal midline (not entire as in the three other species); in the form of the posterior setae on the propodus of pereopod 1 (and in not showing sexual dimorphism for this character); in the form of the mandibular movable spines; in having maxillipedal palp article 2 curved, not cordate; and in lacking triangular extensions on the bases of pleopods 1 to 3.

The brood pouch of one ovigerous female paratype contained juveniles at two separate developmental stages (cf. Moreira, 1973, for *Serolis completa* Moreira). Both stages were clearly of serolid form with six pairs of pereopods but four specimens had obviously calcified cuticles and measured approximately 4 mm in length, while the remaining 19 specimens were less developed, measuring approximately 2 mm in length with the cuticle soft and transparent. These two stages appear to correspond to marsupial stages D and E described for the sphaeromatid isopod *Dynamene bidentata* (Adams) (Holdich, 1968). In *D. bidentata* approximately 25% of all ovigerous females studied contained more than one developmental stage in the brood pouch, and mixed broods occurred especially with embryos at the D and E stages (Holdich, pers. comm.). However, the increase in length from stage D to E in *D. bidentata* was approximately 18% not 100% as noted for *S. levidorsata*. In *D. bidentata*, stage E juveniles leave the brood pouch and it is probable that the larger individuals in the pouch of *S. levidorsata* also represented the final marsupial stage.

Serolis longicaudata Beddard

Figure 6

Serolis longicaudata Beddard, 1884a: 330, 335-7.—1884b: 8, 31, 66, 72-84, 81, pls. 7, 8.—Whitelegge, 1901:2-4, 238.—Chilton, 1917: 393, 394, 397.—Hale, 1929: 307, 309.—Nordenstam, 1933: 16, 17, 39, 45, 47.—Sheppard, 1933: 256, 265, 268-71, 281, 353, 358.—Holdich & Harrison, 1980: 373.

Serolis (Heteroserolis) longicaudata: Nordenstam, 1933: 92, 93.

Material examined: 28 specimens (ovigerous female in Sep.):

SA, off Francis Is., Nuyts Archipelago, 11-24 m, Dr Verco, SAM C385(2). Spencer Gulf, 36 m, A. Zeitz, Feb. 1888, SAM C392(1).

Bass Strait, eastern Bass Strait, 71 m, 2 specimens from BSS stn 171 (NMV J2975). Off Port Phillip Heads, "Challenger" stn 161, BMNH (holotype).

NSW, off Twofold Bay (37°05'S, 150°05'E), sand and mud, 55-91 m, "Endeavour" collection, 30 Sep. 1914, ZMC (4 specimens). Off Jibbon Point, 84-99 m, "Thetis" collection, AM

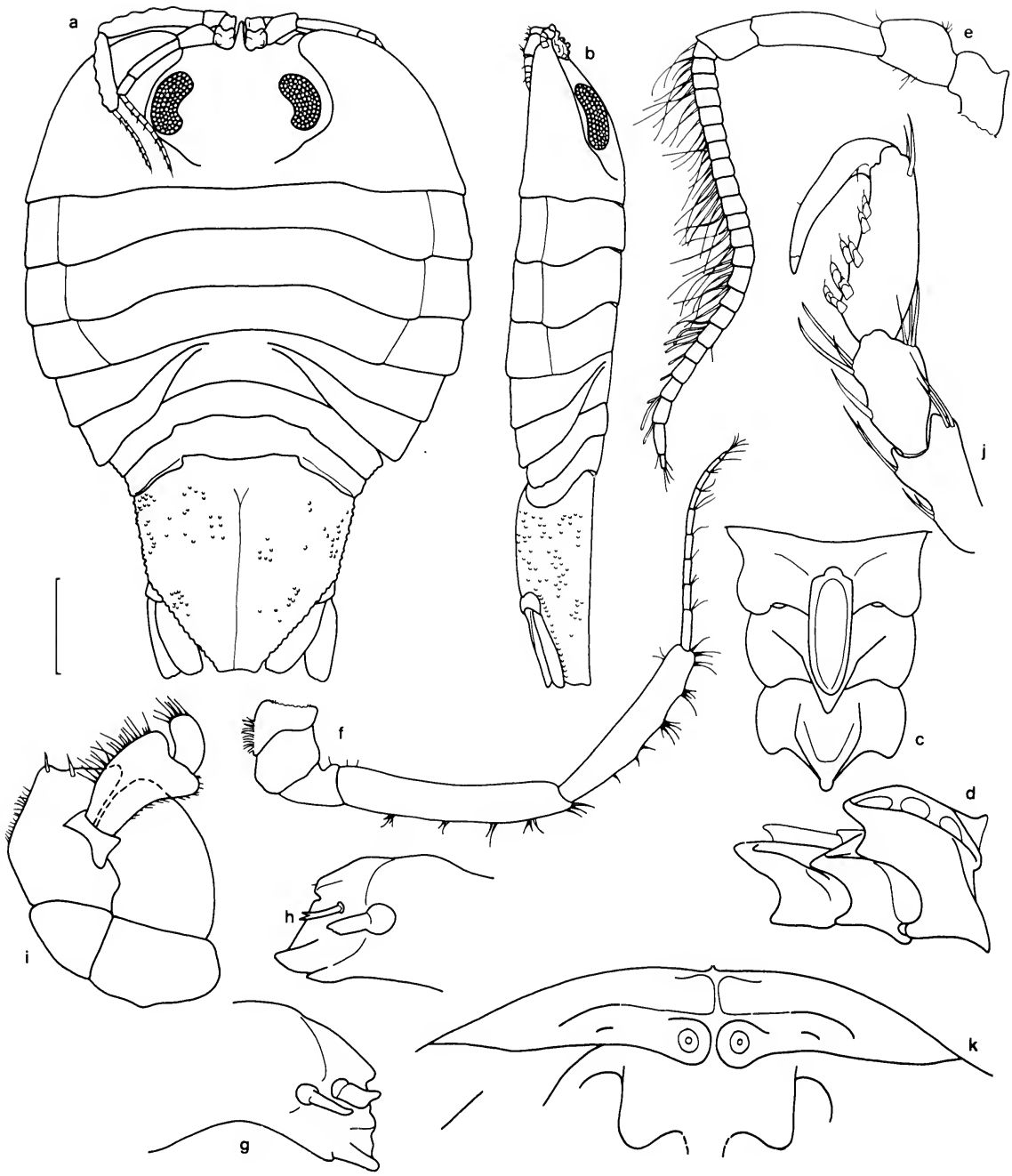

Figure 6. *Serolis longicaudata*, off Twofold Bay. Ovigerous female (ZMC): a, b, dorsal and lateral views; c, d, pleonal sternites. Adult male (ZMC): e, f, antennae 1, 2; g, h, left and right mandibles; i, maxilliped; j, pereopod 2; k, posterior pereonal sternites.

G2266(1). E. of Malabar, 66 m, 13 specimens from 3 AMSBS stations, AM P22774-9.

Description: Body outline pyriform, broad anteriorly; coxal plates of pereonites 2 to 6 subrectangular, truncate, closely applied, not freely projecting; those of pereonites 2 to 4 separated from tergites by sutures. Posterior coxal plates not extended. Head lacking tuberculation. Pereon and pleon smooth, lacking tuberculation. (In some specimens there may be a median keel with median tubercles distinct on the three pleonal tergites and, to a lesser extent, on the pereon (Chilton, 1917)). Pereonite 5 fused with pleonite 1 in dorsal midline. Lateral margins of pleonites 2 and 3 truncate, not extended. Pleotelson as long as broad, proximal half barely tapering, weakly granulose. Pleonal sternites with median extensions each bearing longitudinal grooves; extension of pleonite 1 not reaching apex of that of pleonite 2.

Antenna 1 extending to pereonite 2. Antenna 2 slender, peduncle not flattened, extending to pereonite 3. Uropod arising in posterior half of pleotelson; rami subequal, extending to level of pleotelsonic tip; apex of exopod broadly truncate; apex of endopod rounded.

Adult male. Propodus of pereopod 2 slender, tapering slightly from the proximal to the distal margin and bearing two rows of spines along most of the posterior margin (Table 2).

Distribution: SA, Bass Strait and southern NSW; shelf (type-locality: Bass Strait).

Remarks: In all specimens seen the posterior margin of pereonite 5 shows the same form but as variation occurs in other species it is possible that this character varies for *S. longicaudata*.

Serolis pallida Beddard

Figure 7

Serolis pallida Beddard, 1884a: 330, 335, 336.— 1884b: 11, 15, 31, 66, 70, 74-7, 81, 84, pls. 7, 8.—Whitelegge, 1901: 204, 238.—Chilton, 1917: 394, 396.—Nordenstam, 1933: 13.—Sheppard, 1933: 256, 265, 268, 269, 282, 359.—Holdich & Harrison, 1980: 373.

Material examined: 18 specimens (ovigerous female in Sep.):

NSW, off Twofold Bay (37°05'S, 150°05'E), "Endeavour" collection, 30 Sep. 1914: sand and mud, 55-91 m, ZMC (1 ovigerous female, 1 non-ovigerous female); 70-100 m, ZMC (2 adult males). Off Port Jackson, "Challenger" stn 163, BMNH (1 syntype). E. of Malabar, 66 m: AMSBS stn III, AM P24295(1). Off Cape Three Points, 74-90 m, "Thetis" collection, AM G2156(10). Port Jackson, AM G5375(1).

Bass Strait, eastern Bass Strait, 56-104 m, sandy-shelly sediment: 9 specimens from 5 BSS stations, NMV J2976-80. Off East Moncoeur Is., "Challenger" stn 162, BMNH (1 syntype).

Description: Body outline elongate, ovate. Coxal plates of pereonites 2 to 6 subrectangular, truncate, distally upturned, dorsally slightly concave. Coxal plates of pereonites 2 to 4 separated from tergites by sutures; posterior coxal plates not extended. Head with one pronounced, conical tubercle; eyes reniform, obvious. Pereonites 2 to 4 each bearing a slender acute median tubercle; lacking other obvious tuberculation. Pereonite 5 fused with pleonite 1 in dorsal midline. Pleonal tergites each with a median slender tubercle; lateral margins of pleonites 2 and 3 indented. Pleotelson as long as broad with slight lateral granulation and a low median protuberance either side of midline. Pleonal sternites with all three median extensions bearing longitudinal grooves; extension of pleonite 1 not reaching apex of that of pleonite 2.

Antenna 1 short, extending to posterior margin of pereonite 1; peduncle slender, 1.5 times length of flagellum. Antenna 2 with peduncle greatly flattened, subequal to length of entire antenna 1, with a short slender flagellum. Uropodal endopod not extending as far as pleotelsonic tip, tapering to a narrowly rounded apex; exopod two-thirds length of endopod, apex irregularly indented.

Adult male. Propodus of pereopod 2 broad proximally and tapering distally, its posterior margin bearing two rows of spines along most of its length (Table 2).

Distribution: Southern NSW and Bass Strait (type-locality: off Port Jackson and Bass Strait).

Remarks: In all specimens seen the posterior margin of pereonite 5 shows the same form but

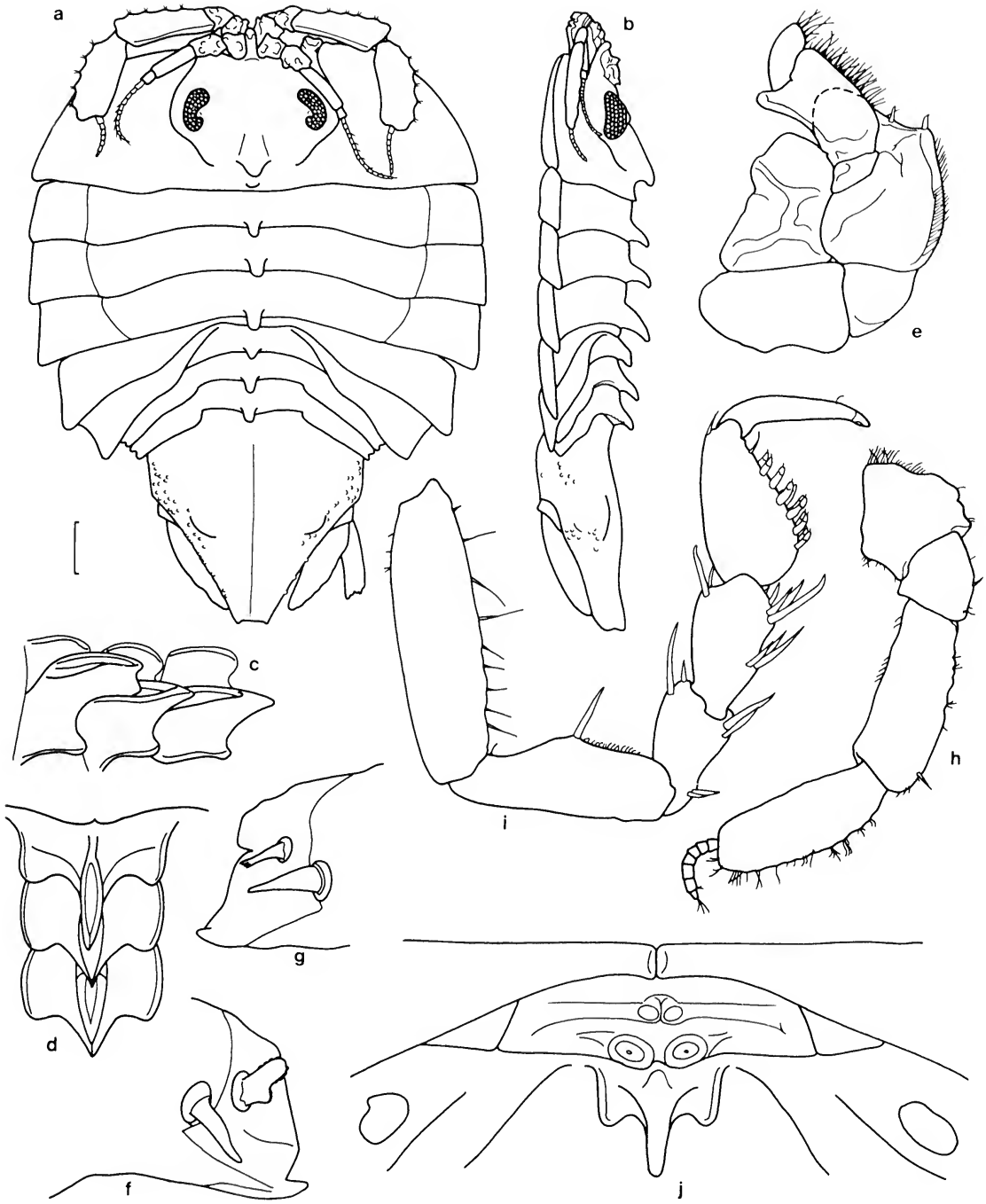

Figure 7. *Serolis pallida*, off Twofold Bay. Non-ovigerous female (ZMC): a, b, dorsal and lateral views; c, d, pleonal sternites; e, maxilliped. Ovigerous female (ZMC): f, g, left and right mandibles; h, antenna 2. Adult male (ZMC): i, pereopod 2; j, posterior pereonal sternites.

as variation occurs in other species, it is possible that this character varies for *Serolis pallida*. Also, in all specimens seen the lateral margins of pleonites 2 and 3 are indented. This indentation is not shown in Beddard's illustration of a type-specimen (1884b: pl. 7, fig. 1) and this character may be variable.

Some specimens from Bass Strait in the collection of the Museum of Victoria appear similar to *S. pallida* with which they co-occur. However, the peduncle of antenna 2 is not particularly flattened and the uropodal exopod is much shorter than in *S. pallida*. Until more material becomes available the identity of these specimens is undecided.

Serolis tuberculata Grube

Figure 8

Serolis tuberculata Grube, 1875: 209, 210, 227-30, 233, 234, pls. 5, 6.—Beddard, 1884a: 330, 334.—1884b: 12, 14-16, 32, 48, 66-68, 81, pl. 6.—Chilton, 1917: 392-8.—Calman, 1920: 299, 300.—Hale, 1929: 307-9.—Nordenstam, 1933: 12, 39, 47-9.—Sheppard, 1933: 256, 265, 268, 269, 282, 358, 359.—Naylor, 1966: 184.—Poore et al., 1975: 33, 64.—Holdich & Harrison, 1980: 373. [not Whitelegge, 1901: 204, 236, 237. See *S. australiensis*]

Material examined: 134 specimens (ovigerous females in Jun. and Nov.):

SA, St Francis Is., Nuyts Archipelago, 11-24 m, Dr Verco, SAM C391(2); 20-30 m, D. Howlett, 29 Dec. 1979, SAM TC3622(1). Pearson Islands, S. A. Shepherd, SAM TC3614(2). Encounter Bay, H. Pulleine, 1889, SAM TC3615(2). W. of Semaphore, 11-13 m, H. M. Hale, SAM C393(1). Spencer Gulf, 18 m, K. Sheard, SAM TC3620(10). Gulf St Vincent, 7 m, SAM C390(2). Spencer Gulf and Gulf St Vincent, 1886 and 1888, SAM TC3616(7). Outer Harbour, H. M. Hale, SAM TC3621(1). Port River, NMV J1459(1). South Australian coast, SAM C388(1), C389(14).

Vic. Lorne, NMV J1458(1). Port Phillip Bay: 4-5 m, sandy sediments, 4 specimens from 3 PPBES stations (NMV J1455, J1456, J1500); off Altona, NMV J1499(1); off Beaumaris, NMV J1457(9). Western Port: 5-14 m, mud and sand sediment, 6 specimens from 5 WBES stations (NMV J1448-52); 7 specimens from other localities (NMV J1453, J1497, J1498, J1501); "Endeavour" collection, 5 Nov. 1914, ZMC(2). Crib Point, 7-19 m, mud, sand and shell sediments, 57 specimens from 25 CPBS stations (NMV J1424-J1447, J1496).

Tas., Frederick Henry Bay, J.R. Penprase, 16 Aug. 1971, TM G1352(1). Great Taylor Bay, Bruny Is., D. Penprase, 25 Jul. 1971, TM G1796(10).

Bass Strait, off Western Port: from fish gut, 1975, NMV J1454(1). Off north-western Tasmania, 18-27 m: BSS stn 108, NMV J2991(2).

NSW, off Twofold Bay (37°05′S, 150°05′E), "Endeavour" collection, 30 Sep. 1914, 55-91 m, ZMC(2); 70-100 m, ZMC(20).

Description: Body outline broad, ovate. Coxal plates of pereonites 2 to 4 separated from tergites by sutures; coxal plates of pereonites 2 to 6 curved, apices acute; posterior coxal plates extended with tips freely projecting. Head with one posterior tubercle. Each pereonite bearing an acute median tubercle and a single transverse row of large irregular tubercles. In the dorsal midline, pereonite 5 may be either: fused completely with pleonite 1; marked posteriorly only by a shallow groove; or completely distinct from pleonite 1. Pleonal tergites each with a median carinate tubercle and a low transverse irregularity either side of the midline, pleonites 2 and 3 wider than pleotelson, margins rounded. Pleotelson broader than long with a median longitudinal carina and, either side of midline, a submarginal ridge and a median transverse ridge which meet as a pronounced tubercle; sometimes a second and third tubercle more posteriorly. Dorsal surface of body bearing short fine setae on the pleotelson, the coxal plates, and along the posterior margins of the tergites. Pleonal sternites with pronounced extensions, that of pleonite 1 extending to apex of that of pleonite 2 and not bearing a longitudinal groove.

Antenna 1 extending to pereonite 4. Antenna 2 slender, peduncle not flattened, extending to pereonite 3. Uropodal endopod extending to pleotelsonic tip, apex broadly rounded; exopod

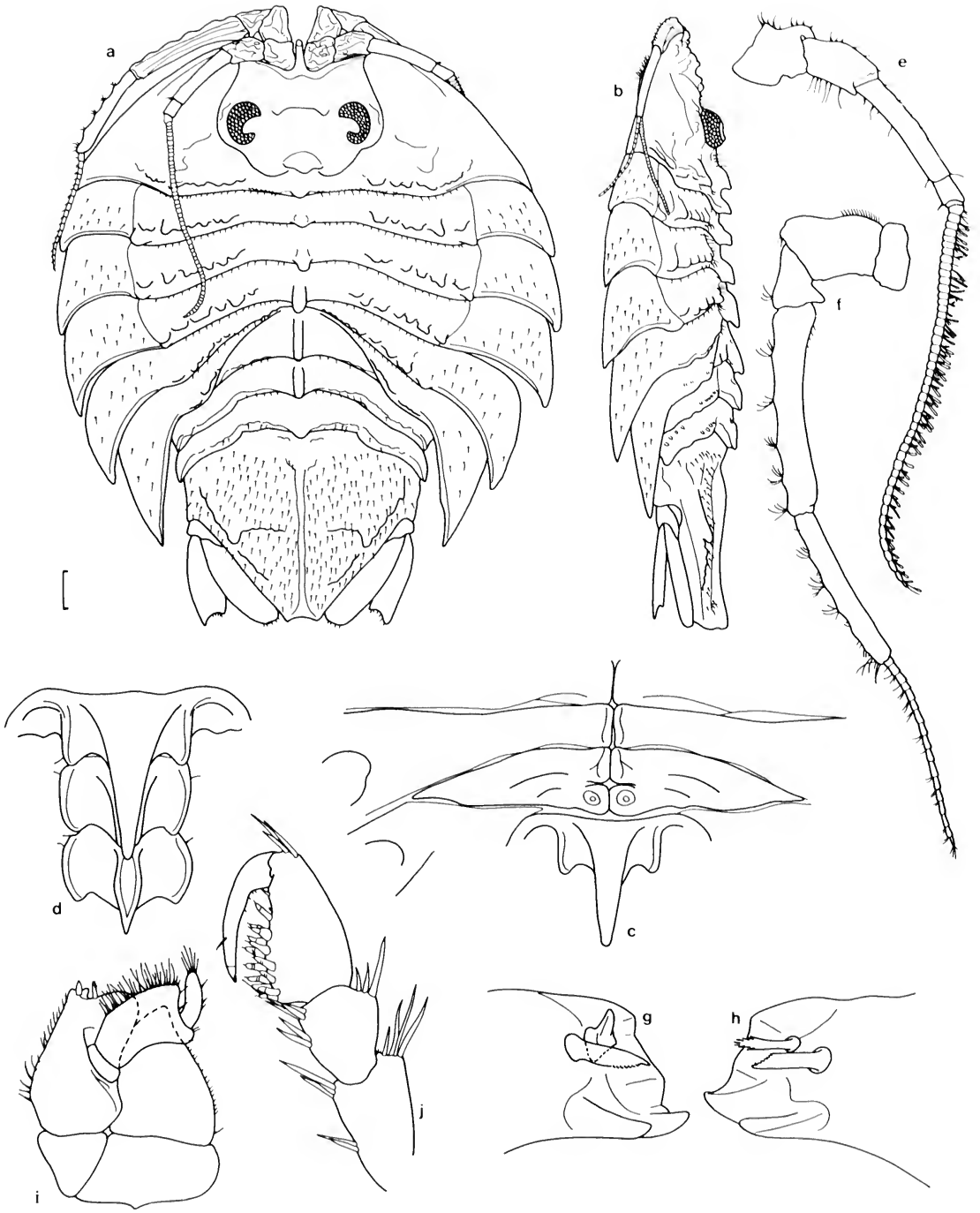

Figure 8. *Serolis tuberculata*, Western Port. Adult male (NMV J1445): a, b, dorsal and lateral views; c, posterior pereonal sternites; d, pleonal sternites; e, f, antennae 1, 2; g, h, left and right mandibles; i, maxilliped; j, pereopod 2.

two-thirds length of endopod, apex markedly emarginate.

Adult male. Propodus of pereopod 2 broad proximally and tapering distally with the posterior margin bearing two rows of short spines along most of its length (Table 2).

Distribution: SA, Vic., through Bass Strait to eastern Tas. and southern NSW; shelf and bays (type-locality: Bass Strait).

Remarks: The presence of dorsal setae is characteristic of this species, and, although individuals vary in the number of setae present, some setae have been found on all specimens examined. Variation also occurs between individuals in the prominence of the dorsal tuberculation and in the degree of coxal plate extension.

Serolis sp.

Figure 9

Material examined: Qld, Halifax Bay, Townsville (19°2.5′S, 146°31.5′E), soft mud on sandy mud, 11 m, P. Arnold, James Cook University, 23 Nov. 1976, QM W7969 (1 subadult male, 1 post-manca).

Description: Subadult male. Body outline elongate, ovate, coxal plates of pereonites 2 to 7 sub-rectangular, closely applied; those of pereonites 2 to 4 separated from tergites by sutures. Head with one low posterior tubercle. Dorsal surface of body lacking tuberculation but bearing a low median carina. In dorsal midline pereonite 5 fused with pleonite 1. Lateral margins of pleonites 2 and 3 not extended. Pleotelson broader than long with a low rounded protuberance either side of midline. Pleonal sternites with all three median extensions bearing longitudinal grooves, extension of pleonite 1 not reaching apex of that of pleonite 2.

Antenna 1 peduncle slender, short; flagellum 1.5 times length of peduncle, extending to level of pereonite 3. Antenna 2 peduncle twice length of antenna 1 peduncle, flattened, slightly expanded; flagellum short, reaching level of pereonite 3. Uropods arising in posterior half of pleotelson; endopod with apex obliquely truncate, not reaching level of pleotelsonic tip; exopod three-quarters length of endopod, apex broadly truncate.

Distribution: North Qld; bays.

Remarks: These specimens appear to differ from the other species described here, but as they are immature it would be inadvisable to describe them as a new species (thereby fixing the type-material as immature specimens). They are included here for completeness and to allow inclusion in the key.

Acknowledgements

In Nottingham, thanks are due to Dr D. M. Holdich for useful discussion.

In Melbourne, we are indebted to Margaret Drummond and Helen Lew Ton who carried out much of the preliminary sorting of the larger collections. For the loan of collections we thank J. K. Lowry, (Australian Museum, Sydney), A. Green, (Tasmanian Museum, Hobart), W. Zeidler, (South Australian Museum, Adelaide), T. Wolff (Zoologisk Museum, Copenhagen), and J. Ellis (British Museum (Natural History), London).

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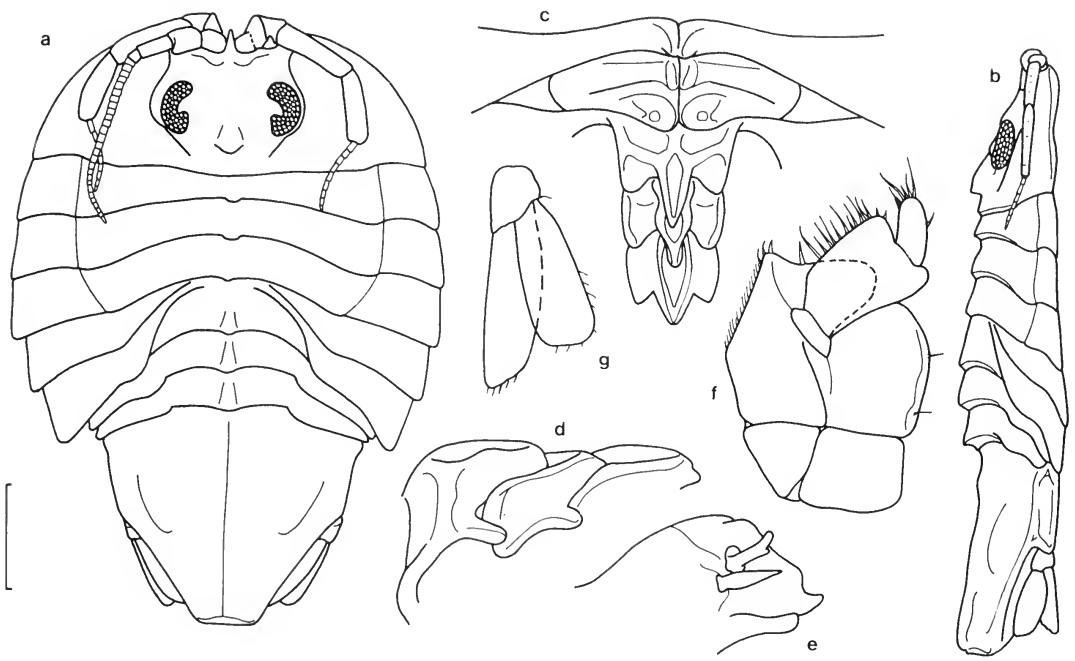

Figure 9. *Serolis* sp., Townsville. Subadult male (QM W7969): a, b, dorsal and lateral views; c, posterior pereonal and pleonal sternites; d, pleonal sternites; e, left mandible; f, maxilliped; g, uropod.

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Note

One of us (GCBP) currently has a paper in press with the *Journal of Crustacean Biology* describing a new serolid genus from Bass Strait. Its discovery requires that some amendments be made to the diagnosis of the Serolidae given here.

PARANTHURA (CRUSTACEA, ISOPODA, PARANTHURIDAE) FROM SOUTH–EASTERN AUSTRALIA

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Abstract

Eleven new species of *Paranthura* (Paranthuridae) are described from the south-eastern Australian coast and shelf: *P. acacia, P. boronia, P. caesia, P. dryandra, P. epacris, P. grevillea, P. kunzea, P. lobelia, P. microtis, P. senecio* and *P. telopea. Paranthura ciliata* Whitelegge, 1901, and *P. involuta* Whitelegge, 1901, are redescribed. A key to their identification is presented.

Australian species of *Paranthura* are sexually dimorphic; males differ from juveniles and females in antenna 1, pereopods, uropods and telson. However, the ways in which dimorphism is expressed are various.

Introduction

In two previous papers (Poore, 1978, 1981) species of six paranthurid genera from south-eastern Australia were described. These are *Accalathura* Barnard, *Aenigmathura* Thomson, *Bullowanthura* Poore, *Colanthura* Richardson, *Leptanthura* Sars, and *Ulakanthura* Poore. Here, species of *Paranthura* Bate & Westwood are dealt with.

To date four Australian species have been referred to *Paranthura. Paranthura australis* Haswell is a nomen dubium, possibly a species of *Leptanthura* (Poore, 1978). Miers' (1884) specimen referred to as *Paranthura australis* became the type of *Apanthura coppingeri* Barnard, 1925. The other two, *Paranthura ciliata* Whitelegge and *P. involuta* Whitelegge, and eleven new species are dealt with here.

The genus *Paranthura*, although clearly distinct from other paranthurids (Poore, 1980) is remarkably homogeneous both in Australia and world-wide. Prior to this work about 28 species were known. Species are distinguished by subtle differences in the shape and proportions of articles of pereopods, uropods and telson. Setation is generally consistent. In several cases morphological differences between juveniles of different species only became apparent after quite distinct males were found (e.g., *P. acacia* and *P. microtis*). In this study relationships between Australian species and those in other parts of the world are not explored. Given the apparent richness of the Australian fauna it is probable that other areas also possess endemic cryptic species as yet undescribed.

Sexual dimorphism occurs as in all Anthuridea (Poore, 1980), males being characterised by the possession of a multiarticulate flagellum on antenna 1, each article bearing numerous aesthetascs, and of a stylet-like appendix masculina on the endopod of pleopod 2. In the south-eastern Australian fauna new forms of modification are noted:

1. Antenna 1. In one species, *P. epacris*, each flagellar article possesses only two aesthetascs, not many.

2. Appendix masculina. In *P. boronia* the appendix masculina is exceptionally broad, half as wide as the uropodal endopod, not stylet like. The appendix reaches further in some species than in others.

3. Pereon. In *P. epacris* the pereon is considerably elongated compared with the female and with males of other species.

4. Pleon. The pleon of the male of *P. caesia* is more shortened than that of the female. Extreme shortening of the pleon is a feature of *P. infundibulata* Richardson from Bermuda and of *P. bellicauda* Miller & Menzies from Hawaii.

5. Telson. The telson may be elongated and dorsally setose as in *P. caesia*. Both sexes of *P. infundibulata* Richardson exhibit this phenomenon.

6. Pereopod 1. The mesial setae along the palm of males are more numerous than in females, as is the case in several anthurideans.

7. Pereopods 2 and 3. Article 6 is more elongate in males than in females.

8. Pereopods 4-7. Particularly in the most posterior limbs, basal articles may be either broader in females (*P. acacia, P. caesia*) or

more elongated (*P. dryandra, P. microtis*). The South African species, *P. latipes* Barnard, known only from males, possesses an extremely broad basis on pereopod 7 and is probably conspecific with *P. punctata* (Stimpson).

9. Uropod. Rami may be broader than in females and mesially setose (*P. acacia, P. caesia*) or narrower (*P. dryandra, P. microtis*). Again, *P. infundibulata* Richardson shows extreme broadening of the male uropodal rami.

The differences between the kinds of sexual dimorphism shown raise serious questions about the taxonomic reality of the genus *Paranthura*. Species groups based on morphology of males are not readily apparent. While *Paranthura epacris* may be separated from all other species on male characters as well as on nonsexual features, among the others there is little correlation between male characters. For example, species with a shortened pleon include those with both broadened and elongated pereopods.

Knowledge of sexual differentiation in Anthuridea is based on work with the genus *Cyathura* which is a protogynous hermaphrodite (Amanieu, 1969; Burbanck and Burbanck, 1974). No similar ecological or experimental study has been attempted with any member of the Paranthuridae which, it appears, may have a different life history.

The descriptions which follow are of ovigerous females or of the largest juvenile. Smaller individuals usually have shorter, broader limbs with fewer spines and setae. After consideration of many characters, only those which are most useful in distinguishing species are used in species descriptions. For example, mouthparts have not been discussed because they are very similar throughout the genus. The written descriptions, therefore, are short, intended only to complement the figures. The sixth article of pereopod 1 bears three rows of setae; the numbers in the setal formula refer to the mesial, palmar, and lateral rows respectively. Only the first two rows mentioned are illustrated. The angle between the palm and the margin of article 5 is given in the descriptions to differentiate axial, oblique and transverse palms. The proportions of distal articles on the walking legs is a useful specific character; the length:breadth ratios used to quantify these are measured from limbs on permanent slides. Similarly, the proportions of uropodal rami and the telson are measured on flattened individuals. For males, only the differences from the main description are noted. In descriptions of the flagellum of antenna 1 the number of articles includes the short basal article and the two minute terminal articles.

Illustrations of limbs are from permanent slides (Gurr's Aquamount). Pereopod 1 is in lateral view, pereopods 2, 4 and 7 mesial views. Uropodal rami and telson are figured flattened, antennae as seen in a horizontal plane attached to head. The figure scale is 1 mm and referable to the whole animal only. In all figures the following abbreviations are used: A1, A2, antennae 1 and 2: P1-P7, pereopods 1-7; PL1, 2, pleopods 1, 2; UN, uropodal endopod; UX, uropodal exopod. Specific epithets of new species are chosen from genera of the Australian flora, used as nouns in apposition. These names allude to the stem *-anthura* (flower tail) in many genera of the Anthuridea.

Material for this study has come from the following surveys and institutions:

Port Phillip Bay Environmental Study, 1969-73 (PPBES) carried out in Port Phillip Bay, Victoria, by the Marine Studies Group, Ministry for Conservation, Melbourne, Vic.;

Crib Point Benthic Survey, 1965-72 (CPBS) and Westernport Bay Environmental Study, 1973-4 (WBES), both carried out in Western Port, Victoria, by the same group;

Bass Strait Survey, 1980-3 (BSS) carried out by the National Museum of Victoria, Melbourne;

Shelf Benthic Survey, 1973 (AMSBS) carried out on the New South Wales shelf by the Australian Museum, Sydney, NSW;

Hawkesbury River Study, 1977-8 (AMHRS) carried out in the Hawkesbury River estuary by the same museum;

and other material from the Museum of Victoria (formerly National Museum of Victoria, Melbourne, NMV), the Australian Museum, Sydney (AM), the South Australian Museum, Adelaide (SAM), the Zoologisk Museum, Copenhagen (ZMC), and the Zoologisches Museum, Universitat Hamburg, West Germany (ZMH).

Key to South-Eastern Australian Species of *Paranthura*

1. Pereopods 1 and 2 with articles 6 of same length; telson 3× as long as wide, more or less parallel-sided for most of length. Pereon of males grossly elongate (14× as long as wide); male antenna 1 articles each with only 2 aesthetascs 2
– Pereopod 1 article 6 longer than that of pereopod 2; telson at most 2.5× as long as wide, usually tapering from midpoint (if not tapering other characters apply). Pereon of males not especially elongated (about 10× as long as wide); male antenna 1 articles each with numerous aesthetascs (males of some species not known) 3
2. Uropodal endopod about as long as wide, inner angle of peduncle sharply produced; pleopod 1 exopod widest at midpoint and tapering to an acutely rounded apex ..... *P. ciliata*
– Uropodal endopod shorter than wide, inner angle of peduncle square, not produced; pleopod 1 exopod widest proximally and tapering to a rounded apex ... *P. epacris*
3. Pleon wider than long; telson 2× as long as pleon 4
– Pleon longer than wide; telson at most 1.5× as long as pleon 5
4. Pleonites 1-5 fused; telson ovate; palm of pereopod 1 almost transverse. Posterior legs and uropodal rami of male more elongate than in juveniles and females ..... *P. telopea*
– Pleonites all free; telson tapering; palm of pereopod 1 axial-oblique. Basis of posterior legs and uropodal rami of male broader than in juveniles and females ..... *P. senecio*
5. Pleonites 2-5 fused dorsally. Basis of posterior pereopods of male broader than in females and juveniles ..... *P. grevillea*
– Pleonites free. Basis of posterior pereopods of males only slightly broadened if at all .. 6
6. Telson about as long as pleon 7
– Telson longer than pleon (usually 1.5× as long) 8
7. Telson parallel-sided for most of length; pereopod 1 palm moderately oblique, proximal thumb separated from cutting edge by an obtuse angle (fig. 17) ..... *P. kunzea*
– Telson tapering from midpoint; pereopod 1 palm strongly oblique, proximal thumb separated from convex cutting edge by a deep angle (fig. 10) ..... *P. dryandra*
8. Pereopod 1 palm oblique and stepped away from axis of limb (fig. 3); antenna 1 flagellum with 6 artricles 9
– Pereopod 1 palm more or less axial (fig. 2); antenna 1 flagellum with 7 or more articles 10
9. Head about 0.7× as wide as long; articles 6 of pereopods 1 and 2 similar in size; adults about 11 mm ..... *P. involuta*
– Head about as wide as long; article 6 of pereopod 1 much larger than that of pereopod 2; adults about 7 mm. Appendix masculina of male robust, one-third width of pleopodal endopod ..... *P. boronia*
10. Telson broad over most of length and rounded terminally (fig. 5); articles 5 and 6 of pereopods 4-7 with 2 and 3 spines respectively; antenna 1 flagellum with 7 articles. Male uropodal rami broadened, these and dorsum of telson especially setose ..... *P. caesia*
– Telson widest proximally and tapering distally (fig. 18); articles 5 and 6 of pereopods 4-7 with 4-5 and 5-6 spines respectively; antenna 1 flagellum with 9 or more articles. Male uropodal rami narrowed or only slightly broadened, especially setose only if rami narrowed 11
11. Pereopod 7 article 6 is 3.5× as long as broad; uropodal endopod shorter than wide. Male telson and uropodal rami mesially setose, telson proportionally longer than in female or juvenile ..... *P. lobelia*
– Pereopod 7 article 6 is 4× as long as broad; uropodal endopod longer than wide. Male telson and uropodal rami not especially setose, telson of similar proportions to female and juvenile 12
12. Uropodal endopod narrowing sharply; with little if any colour; telson moderately tapering. Posterior pereopods and uropodal rami of male slightly broader than in female and juveniles ..... *P. acacia*
– Uropodal endopod broadly rounded;

densely pigmented; telson strongly tapering. Posterior pereopods and uropodal rami of male more elongate than in female and juveniles ..... *P. microtis*

Paranthuridae Menzies & Glynn, 1968

Paranthura Bate & Westwood, 1868

Description: Paranthuridae with eyes. Pereon with feeble dorsolateral grooves, otherwise smooth; pereonites 4-6 without a dorsal pit. Pleonites usually distinct from each other and from telson, rarely pleonites 2-5 fused dorsally. Telson thin, narrow, not indurate and with long terminal setae; statocyst absent. Uropodal endopod usually reaching to end of telson, richly setose; exopod usually lanceolate but rarely broadly so, setose. Antenna 1 flagellum never longer than peduncle, of fewer than 10 articles. Antenna 2 flagellum a short flat setose plate of fused articles, shorter than peduncle. Mandible with an acute incisor, its palp with 3 articles, the last bearing a comb of about 12 setae. Maxilla a sharp, barely-serrate spine. Maxilliped elongate, the stuture between head and basis clear; without an endite; palp of 1-2 articles, the terminal one minute if present; palp with a proximal seta, a dorsal seta and 12-13 terminal setae. Pereopod 1 subchelate, palm axial or moderately oblique, with a mesial cutting edge. Pereopods 4-7 article 5 quadrate, anterior and posterior margins equal. Pleopod 1 exopod operculiform, only slightly indurate.

Adult male usually only slightly more elongate than juvenile or female, sometimes considerably so. A 6- to 8-articled flagellum on antenna 1 bearing fine aesthetascs. Uropodal rami either broader or narrower than in female. Pereopod 7 proximal articles sometimes broadened, sometimes elongated. Telson and uropods sometimes dorsally setose.

Usually with brown pigment dorsally and on some limbs.

Type-species: *Paranthura costana* Bate & Westwood

Paranthura acacia sp. nov.

Figures 1, 2

Material examined: 4 males, 3 females, 7 juveniles; 9.5-16.2 mm:

Holotype: female, 14.0 mm: NMV J1531. Vic., Western Port, Crib Point, (38°20.6′S, 145°14.9′E), shelly-sand sediment, 13 m, 4 Mar. 1965 (CPBS stn 35N).

Paratypes: Vic., Western Port, Crib Point, 5-15 m, CPBS stations: stn 32N, AM P32604 (2 specimens); stn 21S, NMV J1534(2); stn 11N, NMV J1535(1); stn C4, NMV J1536(2); stn A4, NMV J1537(1); stn 300, NMV J1531(1). Western Port, 9-18 m, WBES stations: stn 1735, NMV J1538(1); stn 1747, NMV J1539(1).

Other material: Vic., Western Port, Crib Point, CPBS stations: stn 32S, NMV J1540(1); stn C4, NMV J1541(1).

Description: Female. Head almost as wide as long. Pleon 2× as long as pereonite 7, pleonites 1-6 free. Antenna 1 flagellum of 9 articles. Antenna 2 flagellum 0.8× as long as fifth article of peduncle.

Pereopod 1 article 6 elongate, 1.6× as long as wide; palm axial (10°); proximal thumb broad, separated from the strongly convex cutting edge by a shallow, obtuse angle; setal formula 12, 17, 45. Pereopod 2 article 6 shorter than that of pereopod 1, 1.8× as long as broad, palm with 11 spines. Pereopod 4 articles 5 and 6 each with 5 spines, dactyl fine, 0.8× length of article 6. Pereopod 7 articles 5 and 6 each with 5 spines; article 6 4× as long as wide; dactyl fine, 0.6× length of article 6.

Pleopod 1 endopod bearing 37 setae; exopod widest at midpoint and tapering distally, bearing 53 setae. Pleopod 2 endopod 3× as long as broad, with 11 setae distally; exopod with a partial suture laterally, with 3 setae proximal to suture and 25 setae distally.

Uropodal endopod reaching just beyond end of telson, 1.2× as long as wide, lateral margin weakly convex; exopod 2.2× as long as wide, proximal lobe broadly rounded, distal lobe very broad, tapering to an obtuse apex; with scattered setae on mesial surface. Telson 1.3× as long as pleon, 2.5× as long as wide, widest proximally and tapering to an evenly rounded apex; with numerous terminal long setae, dorsal submarginal short setae on distal half, and scattered dorsal setae elsewhere.

Male. Pereon, pleon, and telson of similar proportions to female. Antenna 1 wih 9

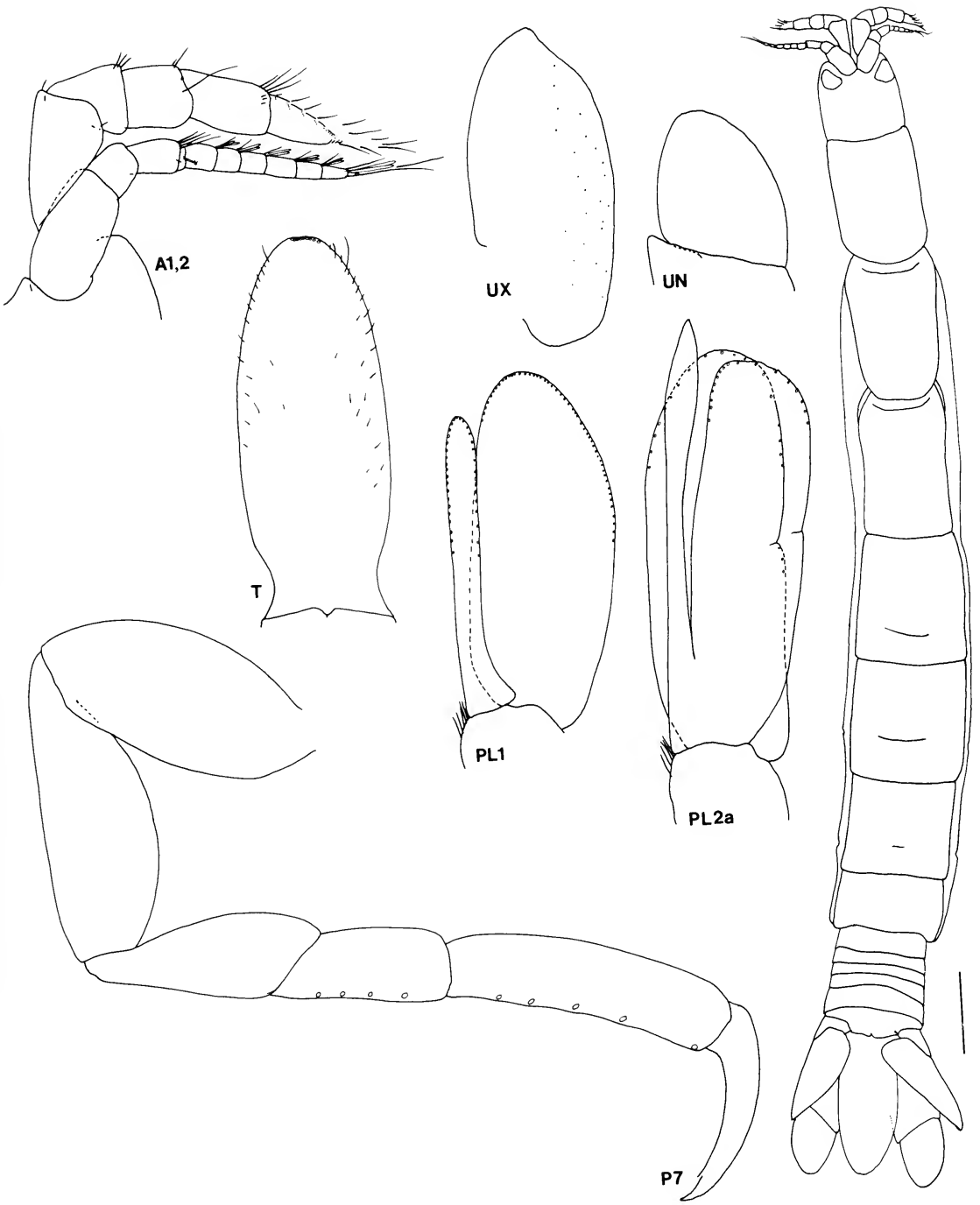

Figure 1. *Paranthura acacia*. Holotype female; a, male, NMV J1532.

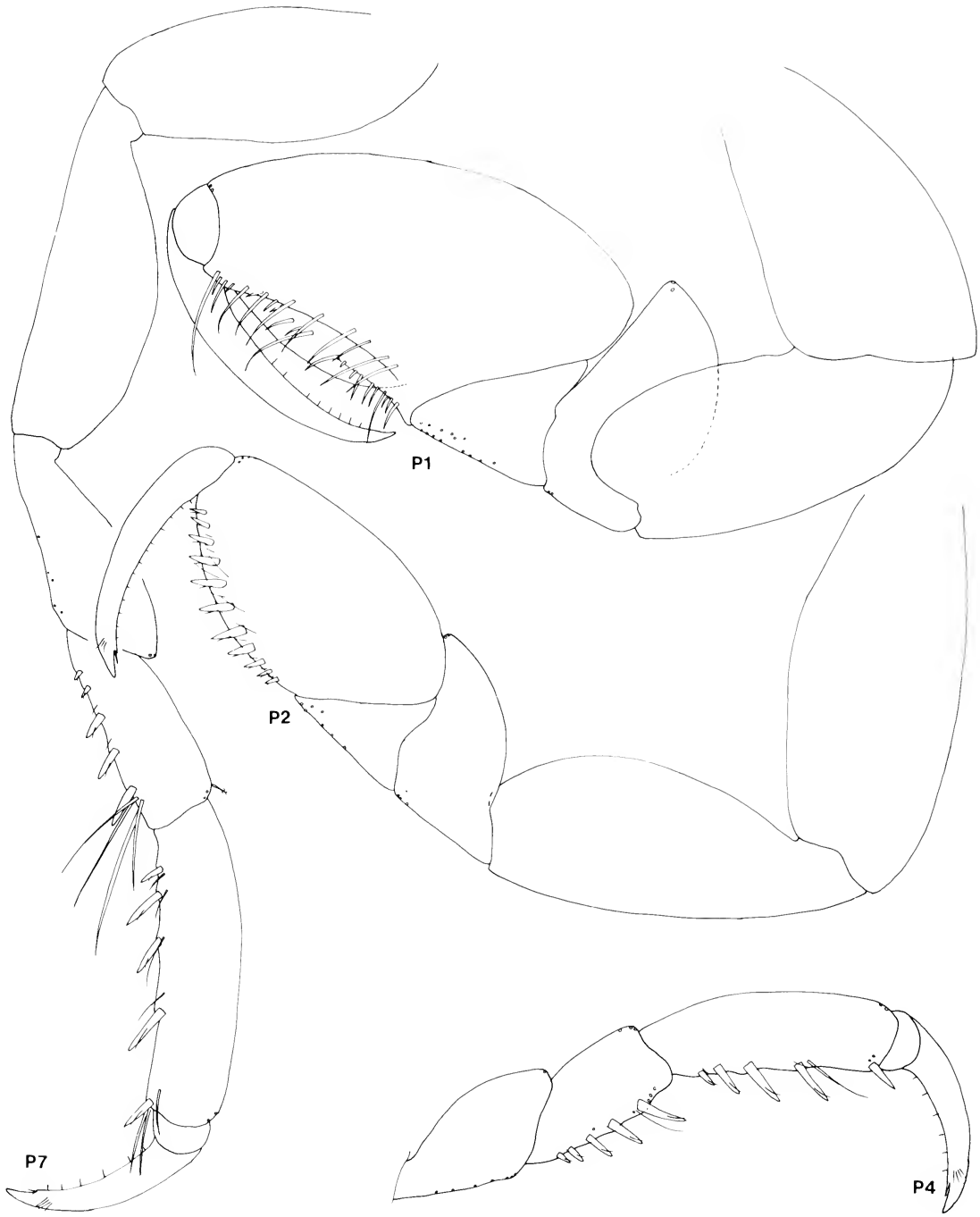

Figure 2. *Paranthura acacia*. Holotype female.

aesthetasc-bearing articles. Pereopod 1 palm with about 60 mesial setae. Pereopod 2 article 6 more elongate. Pereopod 7 basis slightly broader. Uropodal rami only slightly broader, not especially setose. Pleopod 2 with a simple lanceolate appendix masculina, only just exceeding endopod.

Colour: Evenly red-brown with diffuse concentrations of pigment.

Distribution: Western Port, Victoria. Coarse shelly-sand sediment, 5-18 m.

Remarks: *Paranthura acacia* is distinguished from other south-eastern Australian species by the combination of finer dactyls, broad uropodal exopod, and convex palm of pereopod 1.

Paranthura boronia sp. nov.

Figures 3, 4

Material examined: 13 males, 9 females, 9 juveniles; 4.2-6.9 mm:

Holotype: female, 6.4 mm, NMV J1542. Vic., Port Phillip Bay, Swan Bay, (38°14.0′S, 144°39.5′E), silt-clay sediment with *Zostera*, 1 m, 23 Jan. 1973 (PPBES stn 966).

Paratypes: Vic., type-locality, NMV J1543 (1 specimen), NMV J1544(1), NMV J1545(2), NMV J1546(1), NMV J1547(2); AM P32605(4).

Other material: Vic., Western Port, 2-8 m, CPBS stations: stn 12N, NMV J1548(1); stn 21N, NMV J1549(1). Western Port, intertidal, WBES stations: stn 1706, NMV J1550(2); stn 1718, NMV J1551(13). Balnarring, W. F. Seed, 12 Dec. 1968, NMV J1552(2). Apollo Bay, W. F. Seed, 22 Dec. 1970, NMV J1608(1).

Description: Female. Head as wide as long. Pleon 2× as long as pereonite 7, pleonites 1-6 free. Antenna 1 flagellum of 6 articles. Antenna 2 flagellum 0.5× as long as fifth article of peduncle.

Pereopod 1 article 6 elongate, 1.5× as long as wide; palm oblique (30°); proximal thumb acute, separated from the straight cutting edge by a deep acute angle; setal formula 7, 10, 30. Pereopod 2 article 6 shorter than that of pereopod 1, 1.8× as long as broad, palm with 8 spines. Pereopod 4 articles 5 and 6 each with 3 spines; dactyl fine, 0.9× length of article 6. Pereopod 7 articles 5 and 6 with 2 and 3 spines respectively; article 6 3× as long as wide; dactyl fine, 0.7× length of article 6.

Pleopod 1 endopod bearing 12 setae; exopod widest at midpoint and tapering distally, with 26 setae. Pleopod 2 endopod 3.5× as long as broad, with 7 setae distally; exopod with a partial suture laterally, without setae proximal to suture and with 12 setae distally.

Uropodal endopod reaching to end of telson, 1.4× as long as wide, lateral margin weakly convex; exopod 2.1× as long as wide, proximal lobe broadly rounded, distal lobe strongly tapering to an acute apex. Telson 1.3× as long as pleon, 2.4× as long as wide, widest at midpoint and tapering to an evenly rounded apex; with numerous terminal long setae and dorsal submarginal short setae on distal half.

Male. Pereon, pleon, and telson of similar proportions to female. Antenna 1 with 4 aesthetasc-bearing articles. Pereopod 1 setation same as in female. Pereopod 2 article 6 more elongate, but pereopod 7 of similar proportions to female. Uropodal rami narrower than in female but not especially setose. Pleopod 2 with a particularly robust appendix masculina, about half as broad as endopod and well exceeding it.

Colour: No pigmentation on preserved material.

Distribution: Victoria, bays and coast. Intertidal—8 m, muddy sediments, often with *Zostera*.

Remarks: *Paranthura boronia* is distinguished from other south-eastern Australian species by the narrow acute uropodal exopod, narrow endopod and the deep angle between the cutting edge and thumb on the oblique palm of pereopod 1.

Paranthura caesia sp. nov.

Figures 5, 6

Paranthura punctata.—Barnard, 1925: 154 (part from Tasmania).—Nierstrasz, 1941: 252 (part). [Not *Paranthura punctata* (Stimpson)—South Africa].

Material examined: 10 males, 3 female, 89 juveniles; 2.0-15.4 mm:

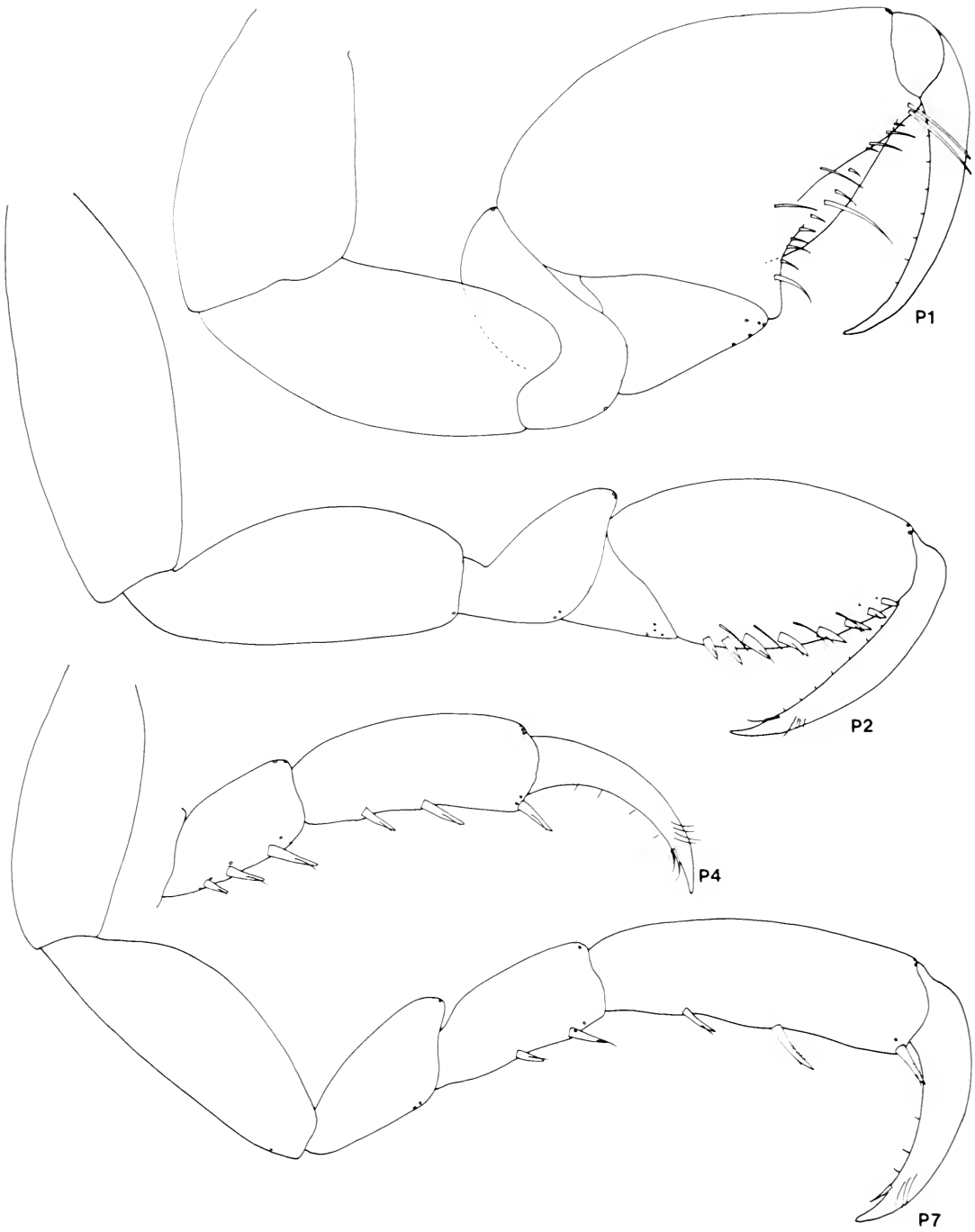

Figure 3. *Paranthura boronia*. Holotype female; a, male, 5.8 mm, NMV J1544.

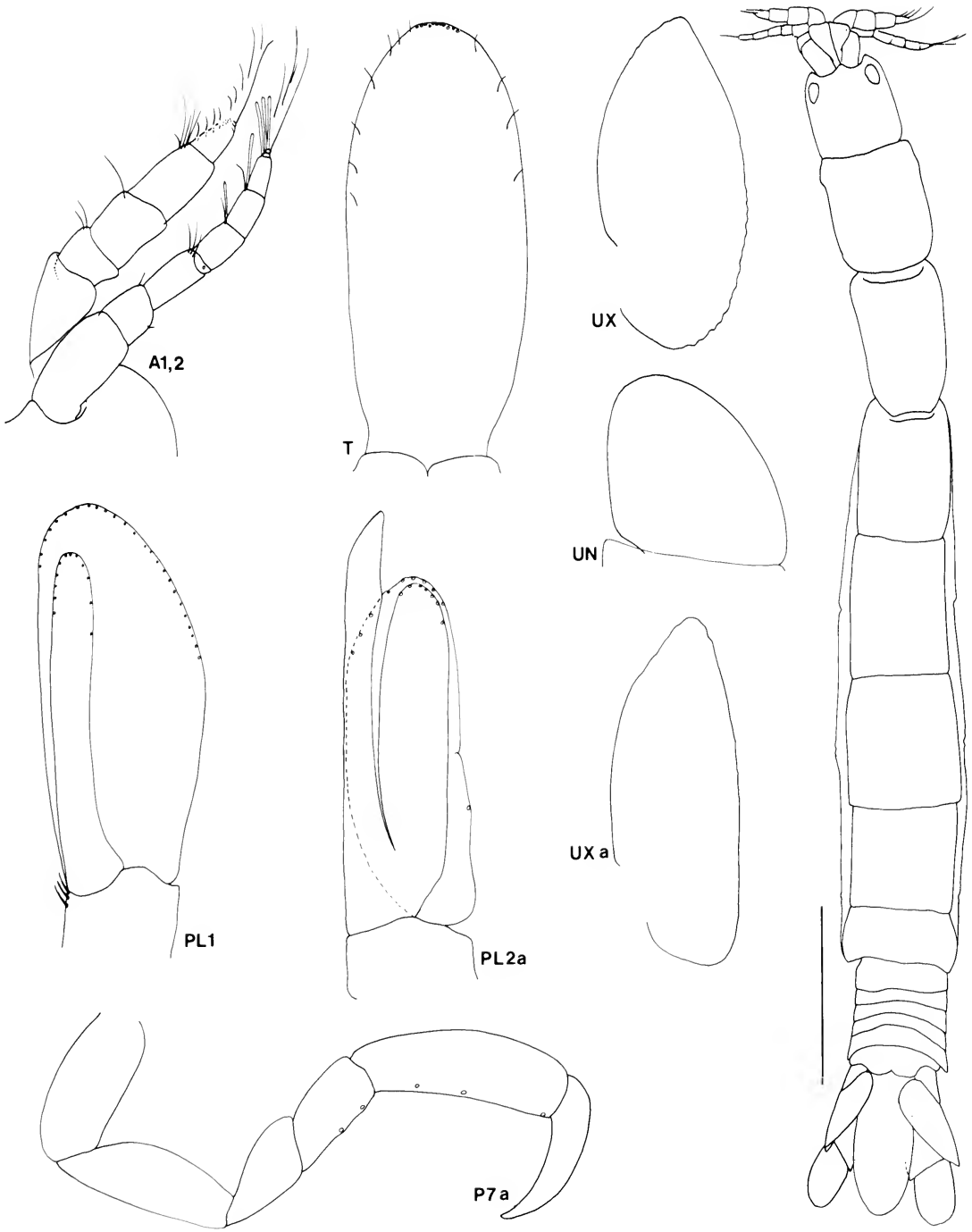

Figure 4. *Paranthura boronia*. Holotype female.

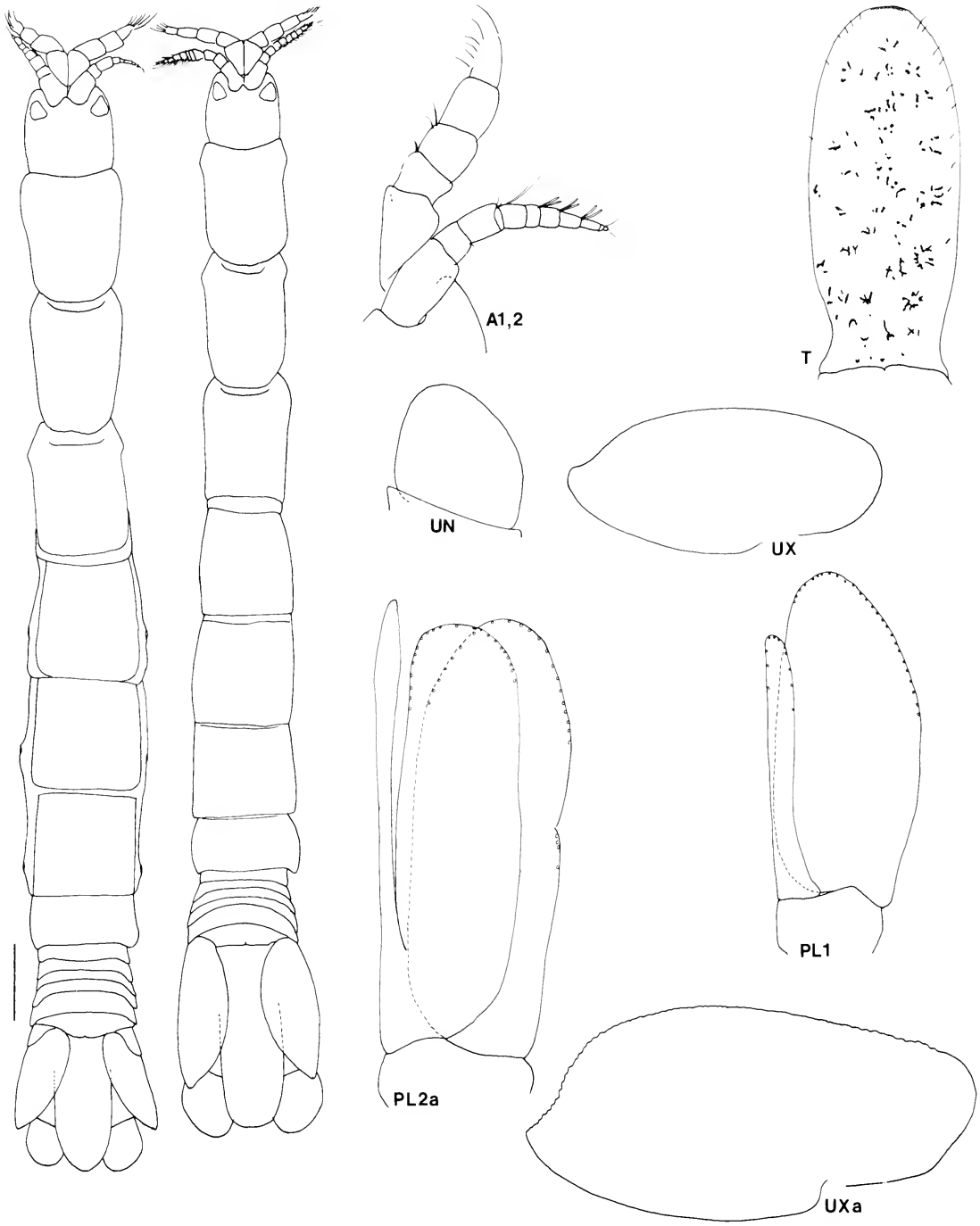

Figure 5. *Paranthura caesia*. Holotype juvenile; a, male, 14.9 mm, NMV J1554.

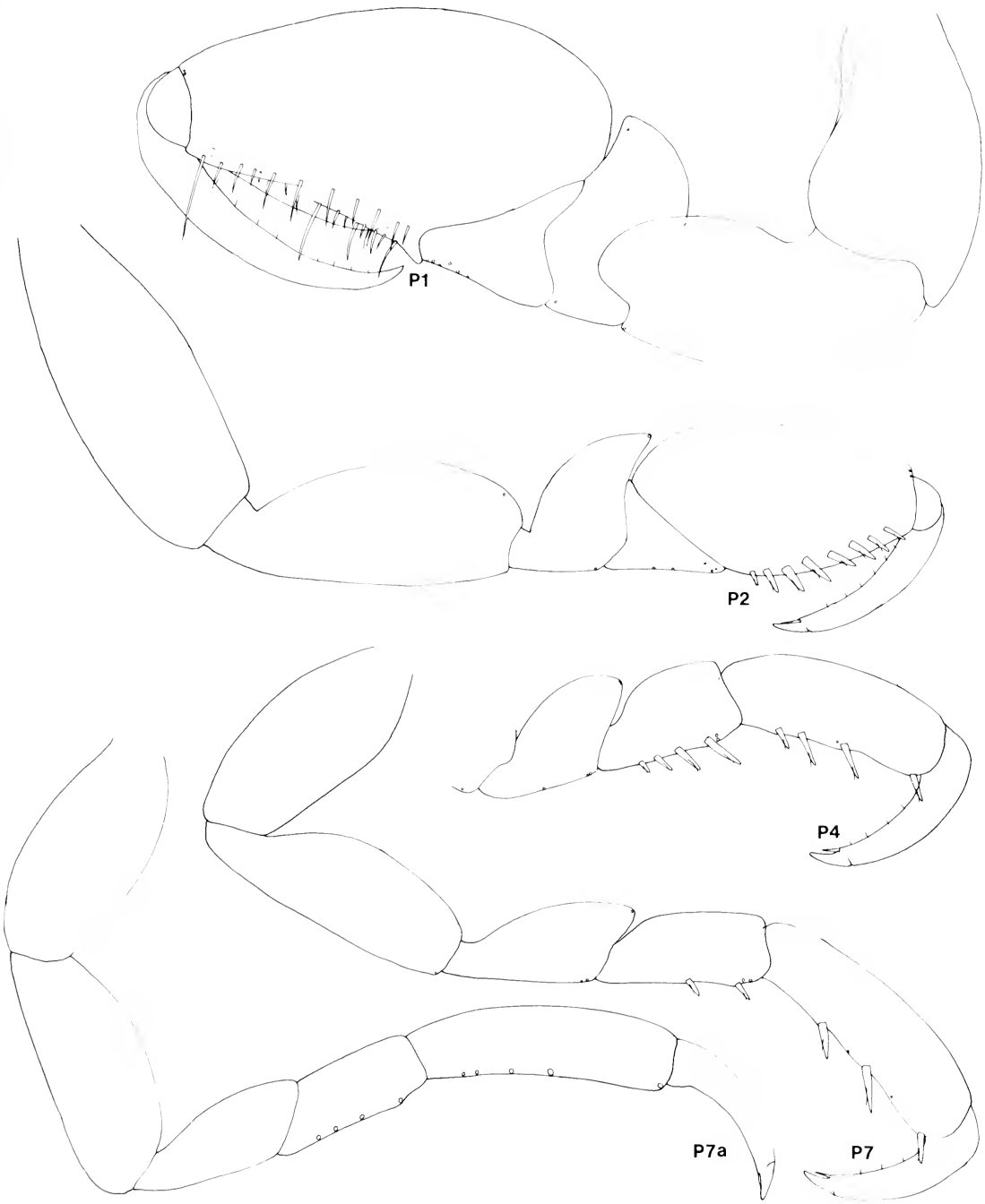

Figure 6. *Paranthura caesia*. Holotype juvenile; a, male, 14.9 mm, NMV J1554.

D1

Holotype: juvenile, 8.6 mm, NMV J1553. Vic., Aireys Inlet, W. F. Seed, 23 Jan. 1968.

Paratypes: Vic., type-locality, NMV J1554 (1 specimen); NMV J1555(33). Aireys Inlet, W. F. Seed, 29 Jan. 1968, AM P32606(7).

Other material: Vic., Shoreham, W. F. Seed, 29 Feb. 1957, NMV J1609(1). Western Port, Honeysuckle Point, T. Crawford, 29 Dec. 1962, NMV J1610(3). Western Port, Crawfish Rock, J. E. Watson and W. F. Seed, 25 Nov. 1972, NMV J1611(1). Balnarring, W. F. Seed, 12 Dec. 1965, NMV J1630(6). Geelong, G. Hartmann and G. Hartmann-Schroeder, 24 Dec. 1975, ZMH(2). Port Phillip Bay, Ricketts Point, O. A. Sayce Collection, NMV J1529(1). Port Phillip Bay, Beaumaris, NMV J1530(6).

Tas., Greens Beach, intertidal, G. Poore, Jan. 1980, NMV J1616(1). Fancy Point, Bruny Is., 3-6 m, G. Edgar: 4 Jul. 1978, NMV J1524(1); 4 Sep. 1978, NMV J1527(1); 10 Oct. 1980, NMV J1525(1), NMV J1526(12). Tinderbox, G. Edgar, 5 Sep. 1980, NMV J1528(1). No specific locality, SAM C3912(1) [labelled *P. punctata* (Stimpson) determ. K. H. Barnard].

NSW, Eden, G. Hartmann and G. Hartmann-Schroeder, 2 Jan. 1976, ZMH(11); Batemans Bay, G. Hartmann and G. Hartmann-Schroeder, ZMH(2).

SA, Port Augusta, G. Hartmann and G. Hartmann-Schroeder, 13 Nov. 1975, ZMH(2). Kangaroo Is., G. Hartmann and G. Hartmann-Schroeder, 14 Dec. 1975, ZMH(1). Kangaroo Is., Vivionne Bay, Hale and Tindale, Jan. 1926, SAM C3910(1). Kangaroo Is., Kingscote, Hale and Tindale, Feb. 1926, SAM C859(2). Marino Reef, Baker and Hale, Feb. 1924, SAM C3908(1).

Description: Juvenile. Head as wide as long. Pleon 2× as long as pereonite 7, pleonites 1-6 free. Antenna 1 flagellum of 7 articles. Antenna 2 flagellum 0.9× as long as fifth article of peduncle.

Pereopod 1 article 6 elongate, 1.7× as long as wide; palm axial; proximal thumb broad, separated from the straight cutting edge by a shallow obtuse angle; setal formula 12, 14, 20. Pereopod 2 article 6 shorter than that of pereopod 1; 1.9× as long as broad, palm with 8 spines. Pereopod 4 articles 5 and 6 each with 4 spines; dactyl stout, 0.8× length of article 6. Pereopod 7 articles 5 and 6 with 2 and 3 spines respectively; article 6 3.5× as long as wide; dactyl stout, 0.6× length of article 6.

Pleopod 1 endopod bearing 12 setae. Pleopod 2 exopod widest at midpoint and tapering distally, bearing 25 setae. Pleopod 2 endopod 2.5× as long as broad, with 4 setae distally; exopod with a partial suture laterally, with 4 setae proximal to suture and 9 setae distally.

Uropodal endopod reaching just beyond end of telson, as long as wide, lateral margin strongly convex; exopod 2.2× as long as wide, proximal lobe narrowly rounded, distal lobe moderately acute. Telson 1.3× as long as pleon, 2.4× as long as wide, widest at midpoint and tapering to an evenly rounded apex; with numerous terminal long setae and dorsal submarginal short setae on distal half.

Male. Pereon of similar proportions to female, pleon shorter (1.6× as long as pereonite 7), telson longer (2.2× as long as pleon). Antenna 1 with 6 aesthetasc-bearing articles. Pereopod 1 with about 60 mesial setae. Pereopod 2 article 6 more elongate. Pereopod 7 basis moderately broadened and longer. Uropodal exopod broader, especially distally, its mesial surface and dorsal surface of the telson densely setose. Pleopod 2 with a simple appendix masculina, only just exceeding the endopod.

Colour: Distinct small red-brown chromatophores dorsally.

Distribution: Southern NSW, Victoria, South Australia and Tasmania, coastal rocky shores. Intertidal-6 m.

Remarks: *Paranthura caesia* is most easily recognised by its large size and distinct small brown dorsal chromatophores but in South Australia may be confused with *P. microtis*. Dactyls on posterior pereopods are particularly stout. The male pleon is shortened and the tail fan densely setose. *Paranthura caesia* is similar to the South African *P. punctata* (Stimpson).

Paranthura ciliata Whitelegge

Figures 7, 8

Paranthura ciliata Whitelegge, 1901: 216-20, figs. 17a-f.—Poore, 1980: 63.

Paranthura flagellata.—Barnard, 1925: 155 (part).—Nierstrasz, 1941: 252 (part). [Not *P. flagellata* (Chilton)].

Material examined: 1 male, 1 female, 2 juveniles; 7.9-12.5 mm:

NSW, E. of Green Cape (37°18′S, 150°19′E), 156 m, trawl, 29 Oct. 1979 (Kapala stn K79-17-17), AM P32658(1). Off Eden (37°05′S, 150°05′E), 70-100 m, T. Mortensen on F.I.S. Endeavour, 30 Sep. 1914, ZMC (1 male).

Bass Strait. Eastern Bass Strait, Flinders Canyon (39°40.3′S, 148°46.5′E), 293-329 m, coarse shell, 27 Mar. 1979 (BSS stn 33), NMV J3001(2).

Description: Juvenile. Head 0.8× as wide as long, tapering only beyond eyes. Pleon little longer than pereonite 7, pleonites 1-6 free. Antenna 1 flagellum of 6 articles. Antenna 2 flagellum 0.5× as long as fifth article of peduncle.

Pereopod 1 article 6 globose, 1.5× as long as wide; palm oblique (20°); proximal thumb broad, barely separated from the convex cutting edge by a shallow angle; setal formula 3, 13, 16. Pereopod 2 total length decidedly longer than pereopod 1. Article 6 as long as that of pereopod 1, 2.0× as long as broad, palm with 10 spines. Pereopod 4 articles 5 and 6 with 4 and 5 spines respectively; dactyl fine, 0.7× length of article 6. Pereopod 7 articles 5 and 6 with 3 and 4 spines respectively; article 6 5× as long as wide; dactyl fine, 0.7× length of article 6.

Pleopod 1 endopod bearing 6 setae; exopod widest at midpoint and tapering sharply to an acute apex, bearing 25 setae.

Uropodal endopod not reaching to end of telson, about as long as wide, lateral margin strongly convex (internal distal angle of peduncle prominently projecting, acute) exopod 2× as long as wide, proximal lobe broadly rounded, distal lobe rounded. Telson 1.2× as long as pleon, little more than 3× as long as wide, more or less parallel-sided, ending in an evenly rounded apex with numerous terminal long setae but without dorsal short setae.

Male. Pereon, pleon and telson of similar proportions to juvenile. Antenna 1 with 4 articles, each bearing 2 aesthetascs. Pereopod 1 palm with about 25 mesial setae. Pereopod 2 article 6 more elongate. Pereopod 7 and uropodal rami not different from female. Pleopod 2 appendix musculina narrow, with an acute tip, reaching well beyond the endopod.

Distribution: Southern NSW shelf and eastern Bass Strait, 98-329 m.

Remarks: Although Whitelegge's type-material cannot be found, these specimens clearly belong to this species. The critical features which were figured by Whitelegge (1901) are the narrow, parallel-sided telson, pleopod 1, uropodal rami, and the internal distal projection of the uropodal peduncle. A very similar species (*Paranthura epacris*) is described here from shallower samples in NSW and Victoria. Both are very narrow species with a short pleon, parallel-sided telson and pereopods 1 and 2 of similar size. The difference between them are discussed with remarks on *P. epacris*.

Barnard (1925) referred to this species under the name of the New Zealand species *Paranthura flagellata* (Chilton) but the telsons of the two species differ.

Paranthura dryandra sp. nov.

Figures 9, 10

Material examined: 10 males, 7 females, 39 juveniles; 2.0-7.2 mm:

Holotype: female, 6.9 mm, NMV J1560. Vic., Aireys Inlet, W. F. Seed, 29 Jan. 1968.

Paratypes: Vic., type-locality, NMV J1561 (1 specimen); NMV J1562(28). Aireys Inlet, W. F. Seed, 23 Jan. 1968, AM P32607(12).

Other material: Vic., Shoreham, W. F. Seed, 28 Feb. 1959, NMV J1612(5); 30 May 1962, NMV J1613(2).

Tas., Cape Portland, 3 m, G. Edgar, 11 Jan. 1981, NMV J1578(3). Fisher Is., with *Caulocystis*, 2 m, G. Edgar, 1 Aug. 1980, NMV J1649(4).

Description: Female. Head 0.9× as wide as long. Pleon almost 2× as long as pereonite 7, pleonites 1-6 free. Antenna 1 flagellum of 6 articles. Antenna 2 flagellum 0.8× as long as fifth article of peduncle.

Pereopod 1 article 6 globose, 1.3× as long as wide; palm oblique (30°); proximal thumb acute, separated from the convex cutting edge

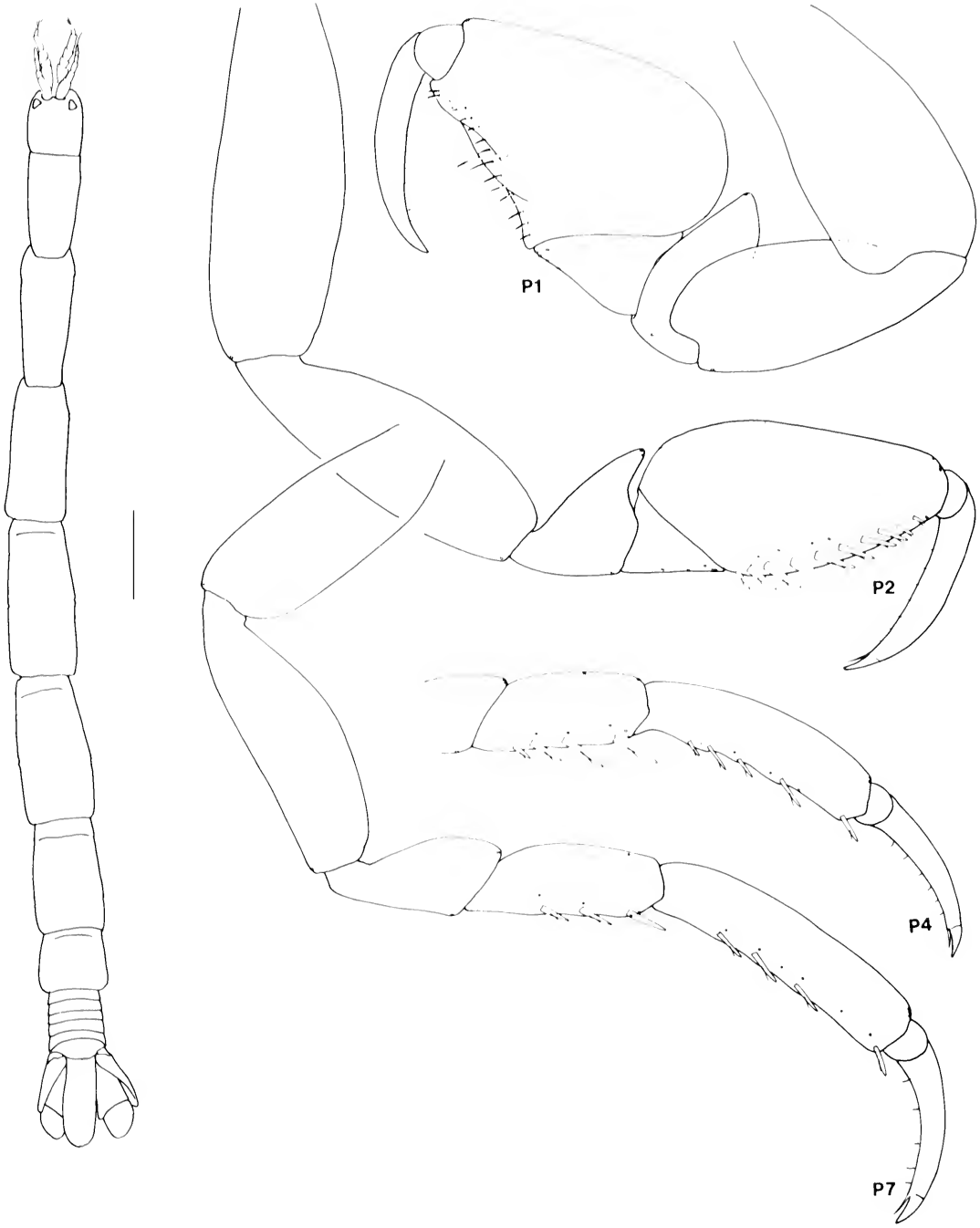

Figure 7. *Paranthura ciliata*. Juvenile, 12.5 mm, AM P32658.

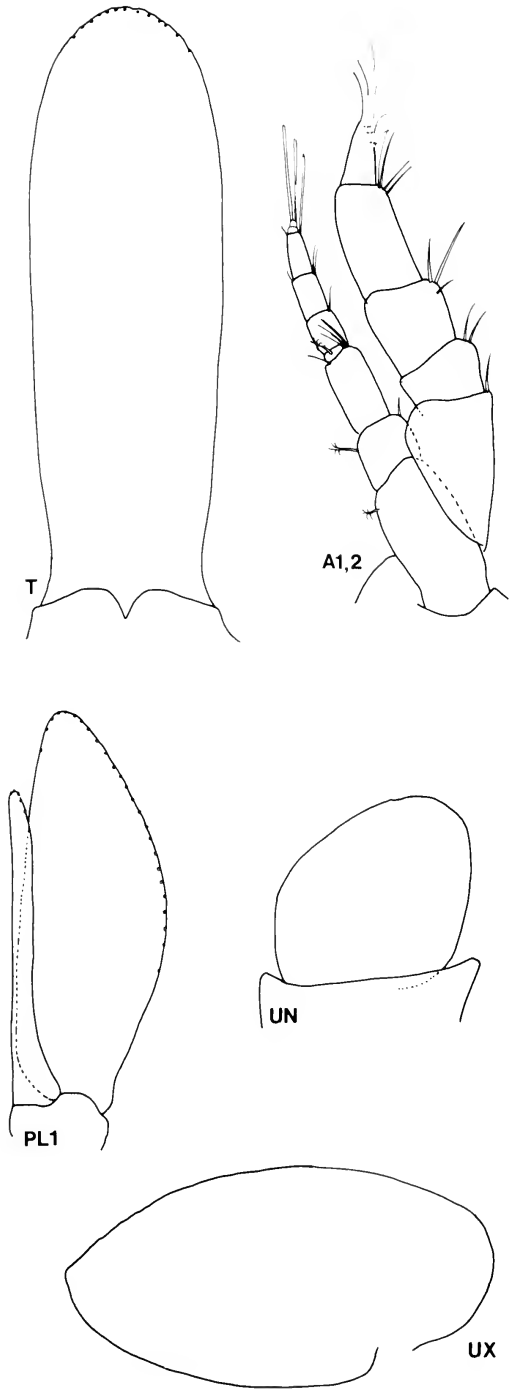

Figure 8. *Paranthura ciliata*. Juvenile, 12.5 mm, AM P32658.

by a deep, obtuse angle; setal formula 5, 9, 15. Pereopod 2 article 6 shorter than that of pereopod 1, 1.6× as long as broad, palm with 7 spines. Pereopod 4 articles 5 and 6 each with 4 spines; dactyl stout, 0.9× length of article 6. Pereopod 7 articles 5 and 6 with 3 and 4 spines respectively; article 6 4× as long as wide; dactyl stout, 0.7× length of article 6.

Pleopod 1 endopod bearing 16 setae; exopod widest in distal half and with rounded apex, bearing 22 setae. Pleopod 2 endopod 3× as long as broad, with 6 setae distally; exopod with a partial suture laterally, with 1 seta proximal to suture and 13 setae distally.

Uropodal endopod reaching to end of telson, as long as wide, lateral margin weakly convex; exopod 2× as long as wide, proximal lobe broadly rounded, distal lobe ending in an obtuse apex. Telson as long as pleon, 2.5× as long as wide, widest at midpoint and tapering to an evenly rounded apex with numerous terminal long setae and dorsal submarginal short setae on distal half.

Male. Pereon a little more elongate than female, pleon and telson of similar proportions. Antenna 1 with 6 aesthetasc-bearing articles. Pereopod 1 palm with about 35 mesial setae. Pereopod 2 article 6 more elongate. Pereopods 4-7 more elongate, basis not broadened. Uropodal rami narrower than in female. Pleopod 2 with a simple appendix masculina, reaching well beyond the endopod.

Colour: Dorsally with dense red-brown chromatophores.

Distribution: Victoria and Tasmania. Intertidal—3 m, rocky shores in algae.

Remarks: *Paranthura dryandra* is notable for its small size, dark colour, and its particularly short telson (only as long as the pleon). The palm of pereopod 1 is especially oblique and its proximal thumb quite acute.

Paranthura epacris sp. nov.

Figures 11,12

Material examined: 8 males, 12 females, 147 juveniles; 5.7-18.0 mm:

Holotype: female, 12.8 mm, NMV J1564. Vic., Western Port, Crib Point (38°21.3'S,

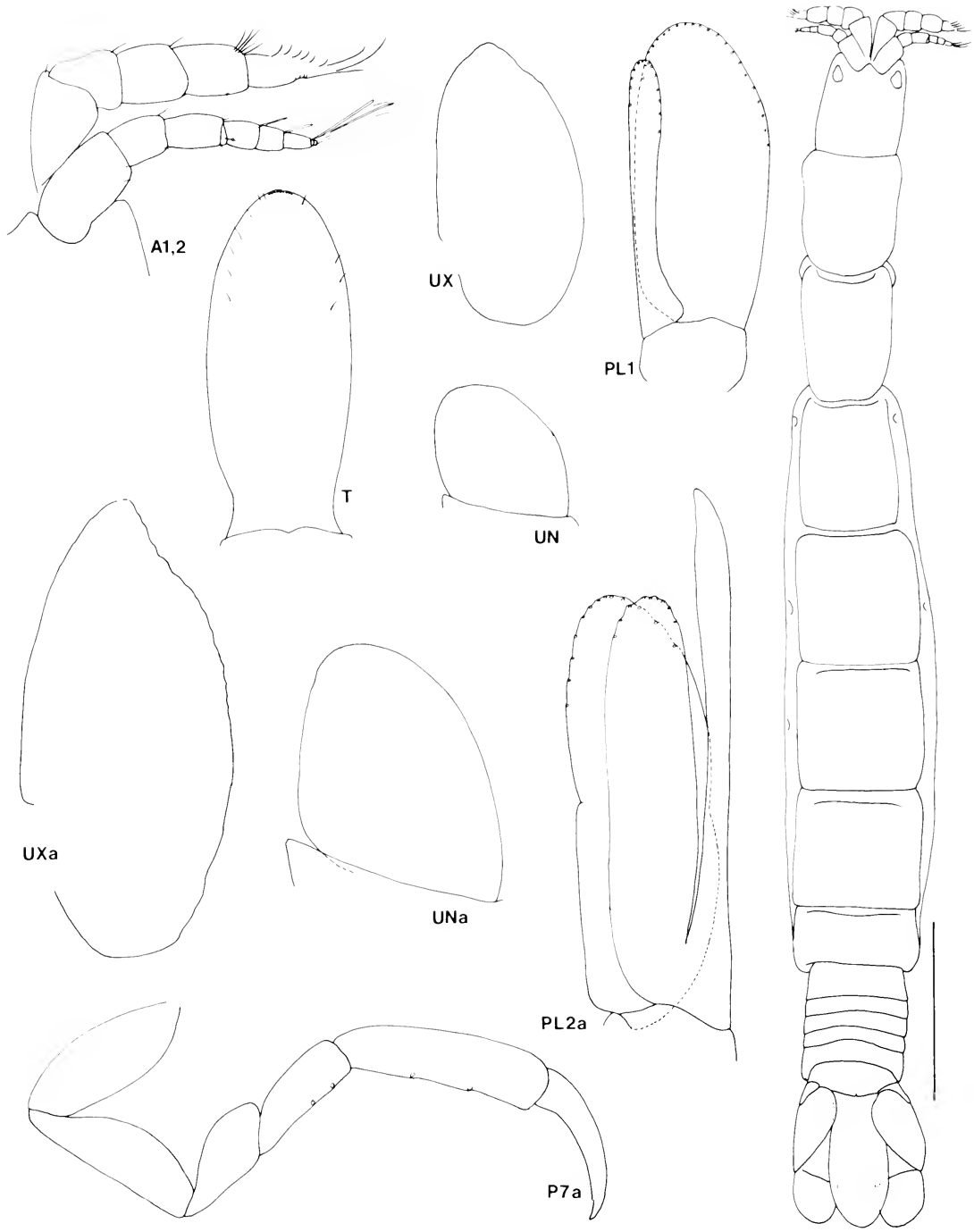

Figure 9. *Paranthura dryandra*. Holotype female; a, male, 7.2 mm, NMV J1561.

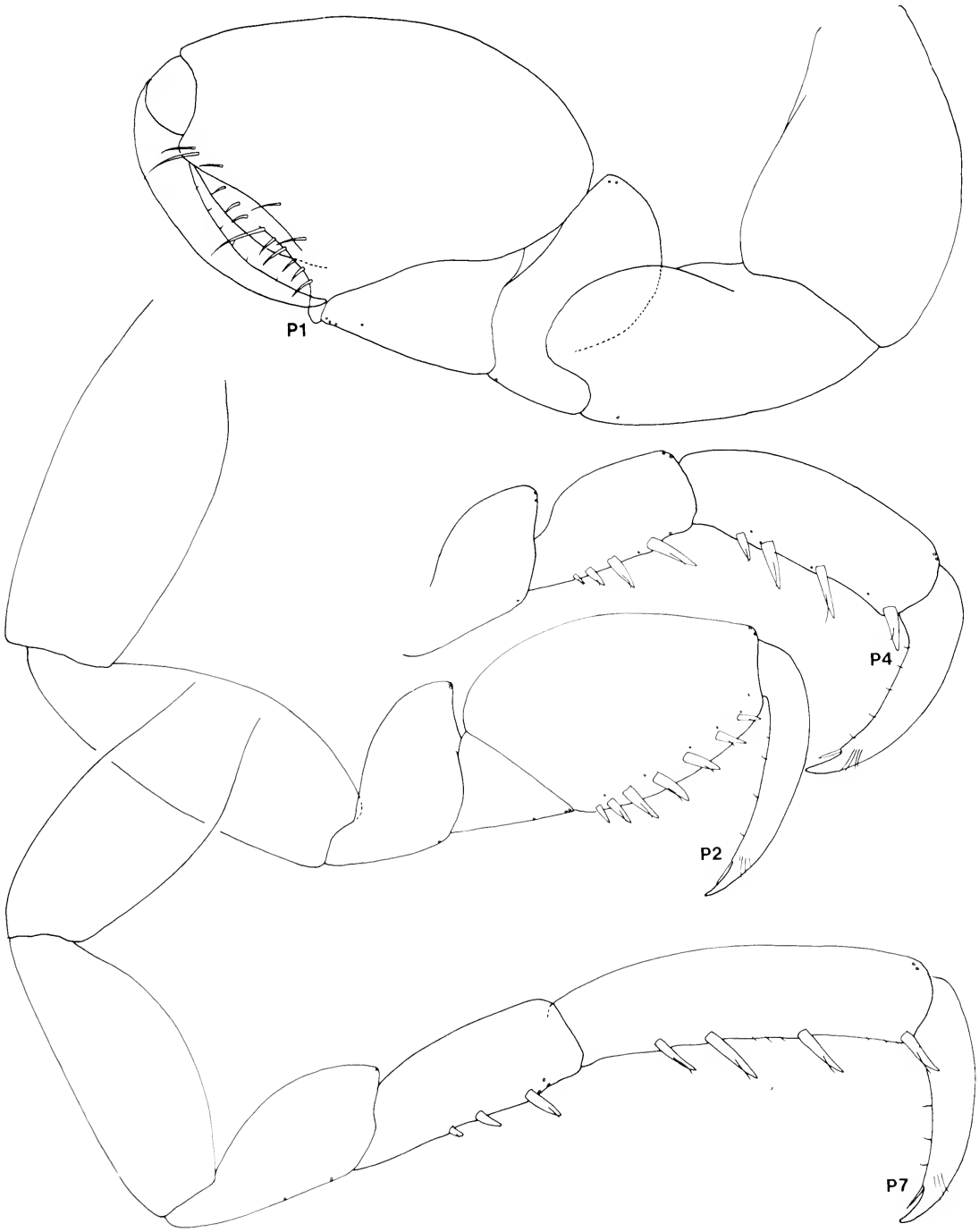

Figure 10. *Paranthura dryandra*. Holotype female.

D3

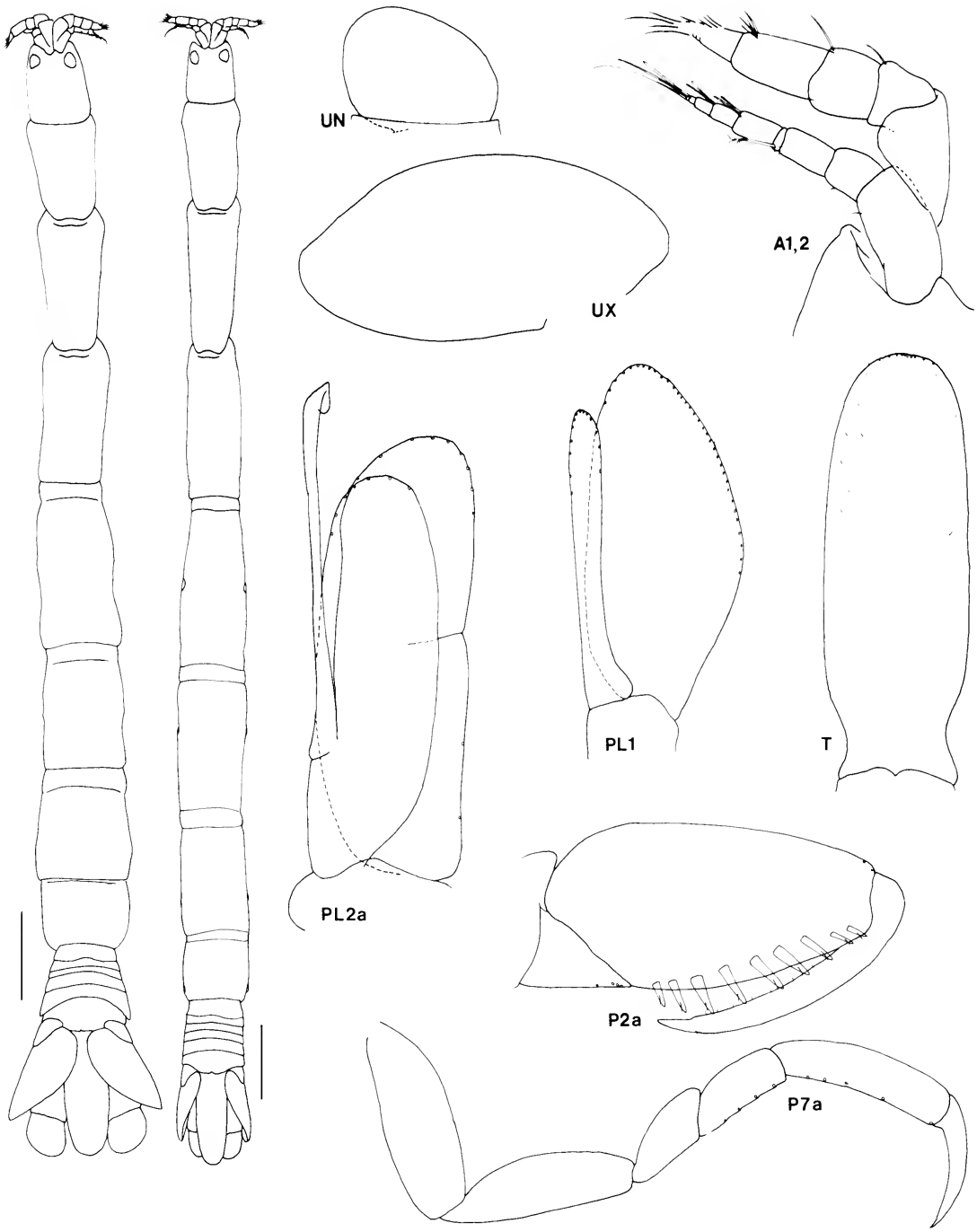

Figure 11. *Paranthura epacris*. Holotype female; a, male, 15.8 mm, NMV J1565.

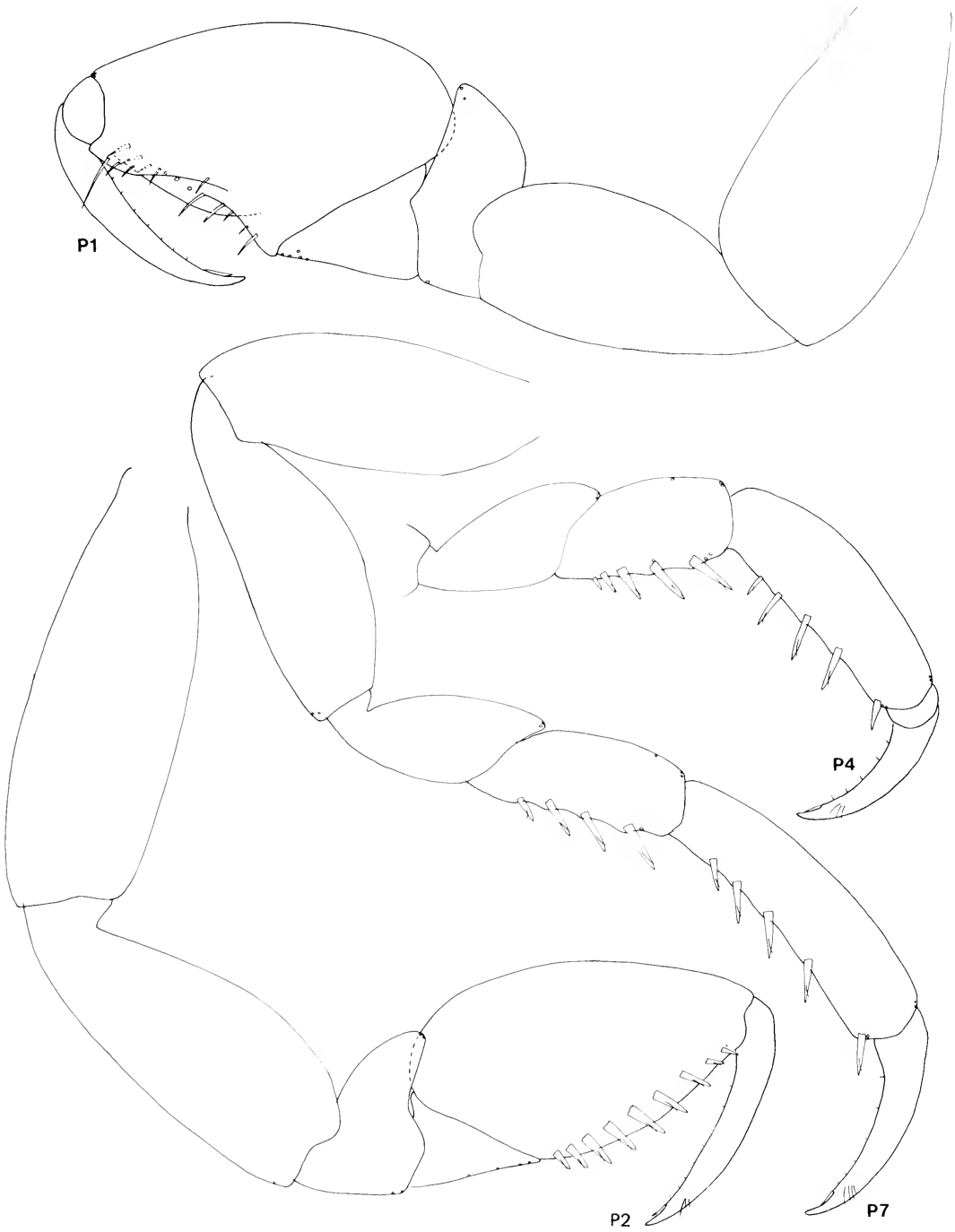

Figure 12. *Paranthura epacris*. Holotype female.

145°13.6′E), fine sand/mud sediment, 15 m, 8 Apr. 1965 (CPBS stn 31S).

Paratypes: Vic., Western Port, Crib Point, CPBS stn 31S; 8 Apr. 1965, NMV J1565 (1 specimen); NMV J1566(8); Apr. 1966, NMV J1567(1); Aug. 1966, NMV J1568(1); Mar. 1967, NMV J1569(4); Aug, 1967, NMV J1570(1); Jul. 1969, NMV J1571(1); Jul. 1970, AM P32608(3); Aug. 1970, AM P32609(2).

Other material: Vic., Western Port, Crib Point; 16 CPBS stations, NMV J1574-5 (131 specimens). Western Port, 4 WBES stations, NMV J1576(4).

NSW, E. of Malabar, Sydney, 31 m, AMSBS stn A1, AM P24348(2). Off Long Reef, Sydney, 24 m, AMSBS, AM P24360(1). Long Reef, Sydney, AM P32610(1). Ulladulla, 80 m, K. Sheard, 9 Aug. 1944, SAM C3911(2).

Tas., Schouten Passage, N. of Schouten Is., 12 m, A. J. Dartnall on F.R.V. Penghana, 8 Jun, 1977, NMV J1615(1).

Description: Female. Head 0.8× as wide as long, widest posteriorly. Pleon 1.3× as long as pereonite 7, pleonites 1-6 free. Antenna 1 flagellum of 6 articles. Antenna 2 flagellum 0.5× as long as fifth article of peduncle.

Pereopod 1 article 6 elongate, 1.6× as long as wide; palm oblique (20°); proximal thumb broad, separated from the convex cutting edge by a shallow obtuse angle; setal formula 6, 13, 16. Pereopod 2 total length decidedly longer than pereopod 1, article 6 as long as that of pereopod 1, 1.8× as long as broad, palm with 9 spines. Pereopod 4 articles 5 and 6 each with 5 spines, dactyl fine, 0.7× length of article 6. Pereopod 7 articles 5 and 6 with 4 and 5 spines respectively; article 6 4× as long as wide; dactyl fine, 0.7× length of article 6.

Pleopod 1 endopod bearing 15 setae; exopod widest in proximal half and tapering distally to rounded apex, bearing 34 setae; Pleopod 2 endopod 3× as long as broad, with 6 setae distally; exopod with a partial suture laterally, without setae proximal to suture and with 13 setae distally.

Uropodal endopod just reaching end of telson, 0.8× as long as wide, lateral margin strongly convex (internal distal angle of peduncle not projecting, square); exopod 2× as long as wide, proximal lobe narrowly rounded, distal lobe broadly rounded. Telson 1.4× as long as pleon, almost 3× as long as wide, more or less parallel-sided, ending in an evenly rounded apex; with numerous terminal long setae and dorsal short setae on distal half.

Male. Pereon much more elongate than in female (14× as long as wide, cf. 9× as long as wide in female). Pleon shorter (as long as pereonite 7), telson shorter (as long as pleon). Antenna 1 flagellum with 4 articles, each bearing 2 aesthetascs. Pereopod 1 palm with about 30 mesial setae. Pereopod 2 article 6 more elongate. Pereopod 7 and uropodal rami not different from female. Pleopod 2 appendix masculina narrow, with an acute tip, reaching well beyond the endopod.

Colour: None on most preserved material.

Distribution: Southern NSW, Victoria (Western Port), eastern Tasmania. Intertidal–80 m.

Remarks: *Paranthura epacris* shares with *P. ciliata* a narrow non-tapering telson. It differs in several minor features: flagellum of antenna 1 is shorter; article 6 of pereopod 2 is less elongate; uropodal endopod is shorter; the inner distal angle of the uropodal peduncle is square and not produced; and the exopod of pleopod 1 is less sharply tapering. These are very small differences but so far no intermediate forms have been found.

The species overlap geograpically in NSW but *Paranthura epacris* is not found in such deep water as *P. ciliata*. The male of *P. epacris* is especially elongate and the aesthetascs of antenna 1 are poorly developed. The male of *P. ciliata* is similarly specialised.

Paranthura grevillea sp. nov.

Figures 13, 14

Material examined: 3 males, 5 juveniles, 3 mancas; 2.5-7.3 mm:

Holotype: juvenile, 5.6 mm, AM P24364. NSW, E. of North Head, Sydney (33°49′S, 151°18′E), 20 m, in association with the sponge *Polymastea craticia*, SCUBA (AMSBS station).

Paratypes: NSW, E. of North Head, Sydney, AMSBS stations; 21 m, AM P22812 (1 specimen); 21-27 m, AM P22823(1).

Other material: NSW, Lord Howe Is., Old Gulch, among algae on midlittorial boulders, J. Lowry, 17 May 1977, AM P29811(1). Lord Howe Is., between Comet Hole and reef, 2-3 m, J. K. Lowry, 10 May 1977, AM P29807(6), NMV J1533(1).

Description: Juvenile. Head 0.8× as wide as long. Pleon 1.8× as long as pereonite 7, pleonites 1 and 6 free, 2-5 fused dorsally. Antenna 1 flagellum of 5 articles. Antenna 2 flagellum 0.7× as long as fifth article of peduncle.

Pereopod 1 article 6 elongate, 1.5× as long as wide; palm oblique (30°); proximal thumb broad, separated from the convex cutting edge by a shallow obtuse angle; setal formula 5, 6, 10. Pereopod 2 total length about as long as pereopod 1; article 6 2× as long as broad, palm with 6 spines. Pereopod 4 articles 5 and 6 each with 3 spines; dactyl stout, 0.8× length of article 6. Pereopod 7 articles 5 and 6 with 1 and 2 spines respectively; article 6 3× as long as wide; dactyl stout, 0.7× length of article 6.

Pleopod 1 endopod bearing 5 setae; exopod widest in proximal half and tapering distally, bearing 15 setae. Pleopod 2 endopod 3× as long as broad, with 3 setae distally; exopod with partial suture laterally, without setae proximal to suture and with 7 setae distally.

Uropodal endopod reaching beyond end of telson, almost as long as wide, lateral margin strongly convex; exopod 2.1× as long as wide, proximal lobe narrowly rounded, distal lobe tapering to rounded apex. Telson 1.2× as long as pleon, 2.5× as long as wide, widest at midpoint and tapering to a broadly rounded apex; with numerous terminal long setae and dorsal submarginal short setae on distal half.

Male. Pereon of similar proportions to juvenile. Pleon shorter (1.6× as long as pereonite 7), telson longer (1.7× as long as pleon) than in juvenile. Antenna 1 with 5 aesthetasc-bearing articles. Pereopod 1 palm with about 35 mesial setae. Pereopod 2 article 6 more elongate than in juvenile. Pereopod 7 articles (especially basis) broader than in juvenile. Uropodal rami narrower than in juvenile. Pleopod 2 with a long simple appendix masculina, well exceeding the endopod.

Colour: Scattered dorsal red-brown pigment.

Distribution: NSW shelf and Lord Howe Is., on algae and sponges. Intertidal–27 m.

Remarks: Fused pleonites distinguish *Paranthura grevillea* from all other species. Like some other small species (*P. boronia, P. dryandra*) *P. grevillea* possesses an oblique palm on pereopod 1. However, the species is distinguished from these by the rounded apex to the uropodal exopod and the broadened basis in posterior pereopods of the male.

Paranthura involuta Whitelegge

Figure 15

Paranthura involuta. Whitelegge, 1901: 220-4, figs. 18a-g.—Barnard, 1925: 156.—Nierstrasz, 1941: 252.—Poore, 1980: 63.

Material examined: Holotype: juvenile, 11 mm, AM G2403. NSW, off Botany Bay, 90-93 m. (Thetis stn 37).

Description: Holotype juvenile. Head 0.7× as wide as long, widest posteriorly. Pleon about 2× as long as pereonite 7, pleonites 1-6 free. Antenna 1 flagellum of 6 articles. Antenna 2 flagellum 0.7× as long as fifth article of peduncle.

Pereopod 1 article 6 elongate, 1.6× as long as wide; palm oblique (20°); proximal thumb broad, well separated from the convex cutting edge by a shallow obtuse angle; setal formula 5, 11, 13. Pereopod 2 article 6 about as long as that of pereopod 1, 1.5× as long as broad, palm with 10 spines. Pereopod 4 articles 5 and 6 each with 4 spines; dactyl stout, 0.6× length of article 6. Pereopod 7 articles 5 and 6 with 3 and 4 spines respectively; article 6 5× as long as wide; dactyl moderately stout, 0.6× length of article 6.

Uropodal endopod 2× as long as wide, lateral margin weakly convex; exopod 3× as long as wide. Telson about 2.5× as long as wide, widest at midpoint and tapering to an acute apex; with numerous terminal long setae.

Male. Unknown.

Colour: "Pale creamy-white" (Whitelegge, 1901).

Distribution: NSW shelf, 90-93 m.

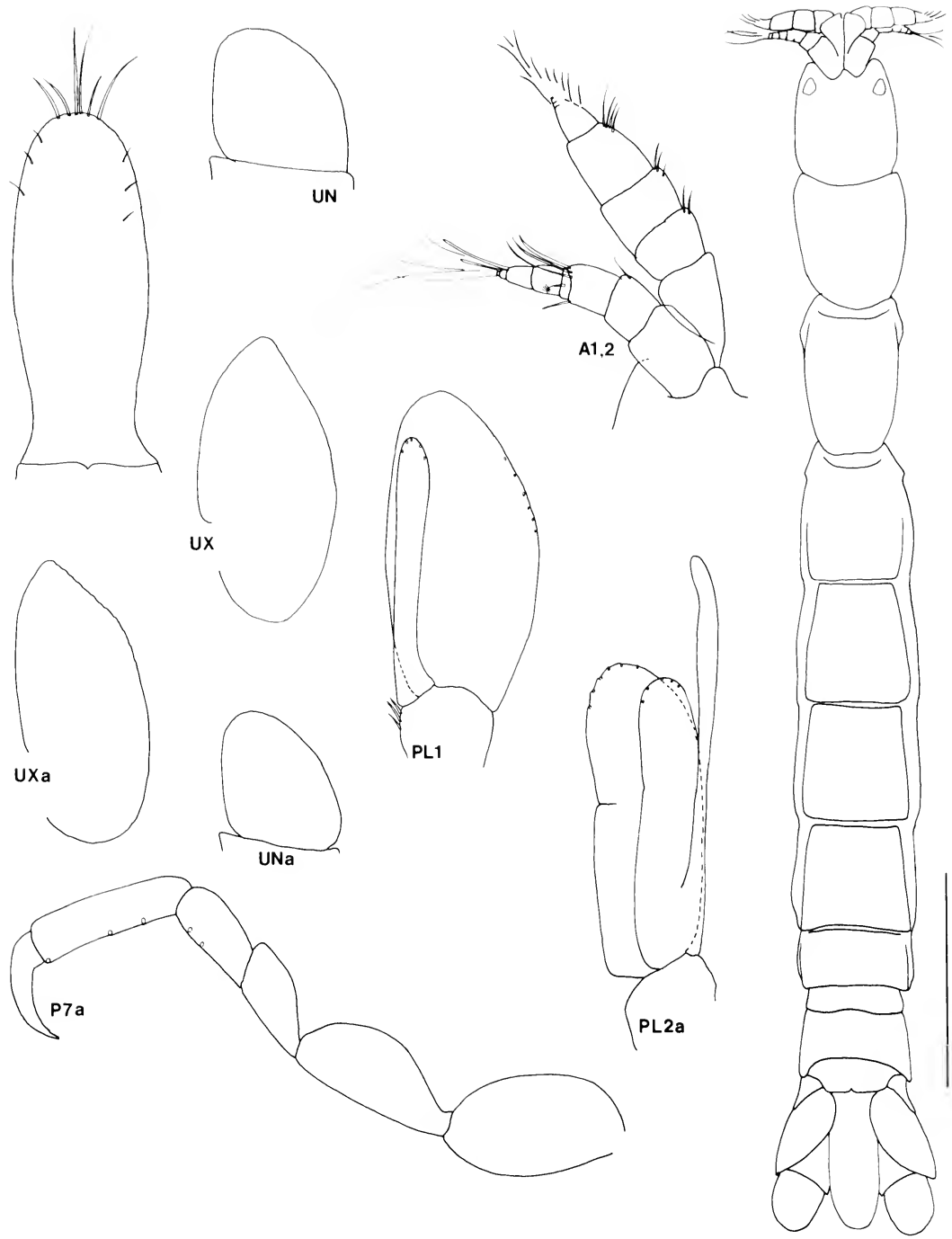

Figure 13. *Paranthura grevillea*. Holotype juvenile; a, male, 7.3 mm, AM P22821.

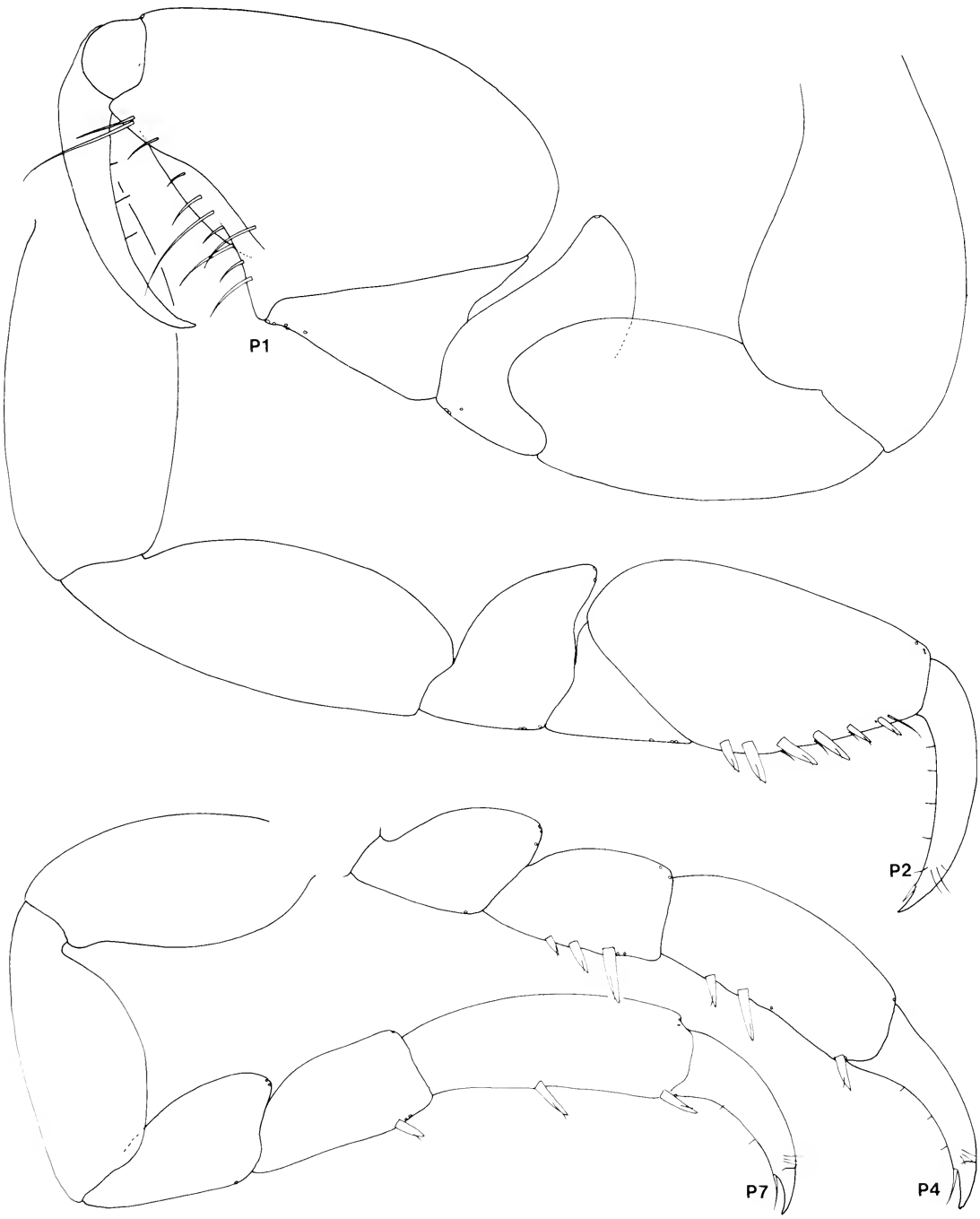

Figure 14. *Paranthura grevillea*. Holotype juvenile.

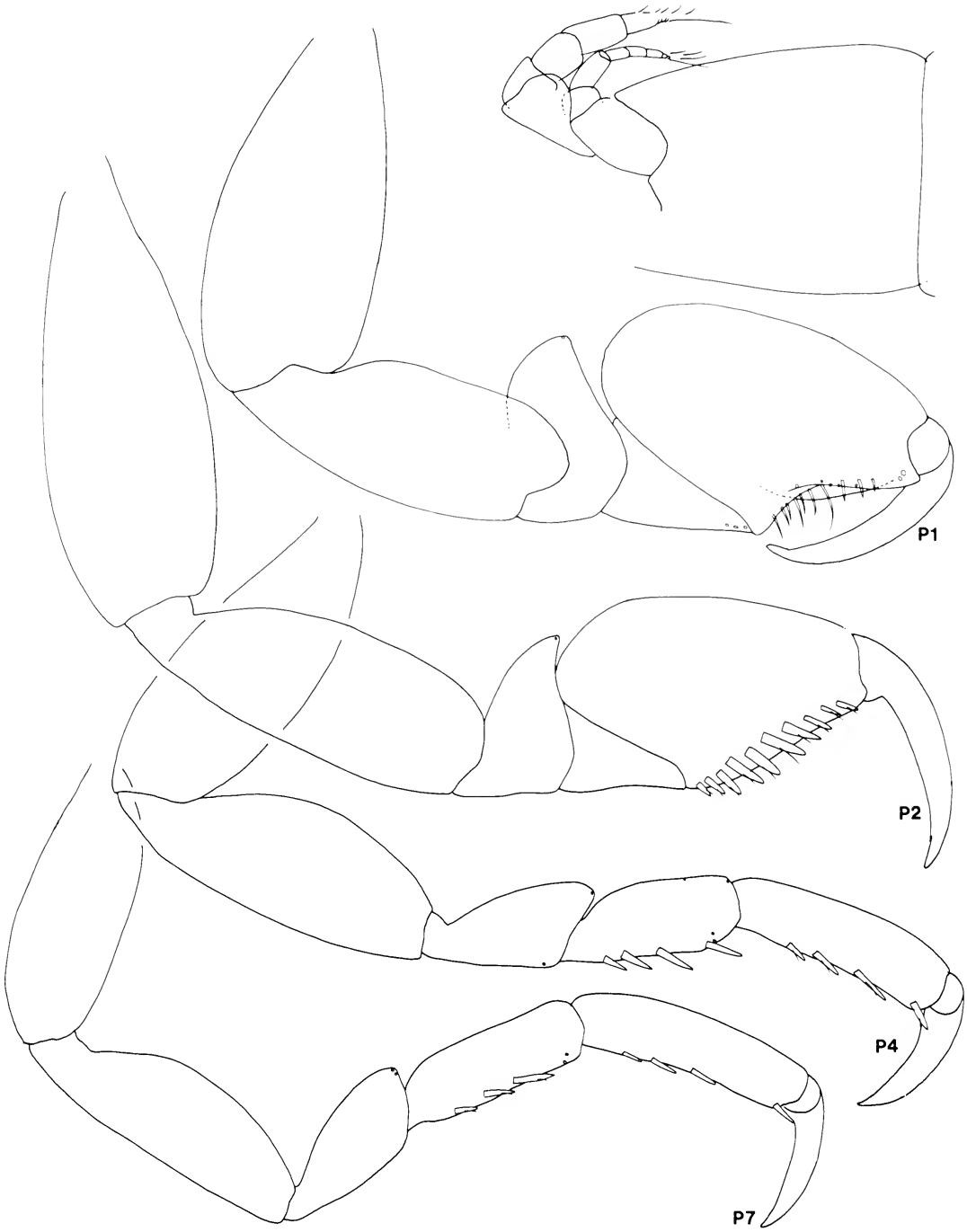

Figure 15. *Paranthura involuta*. Holotype juvenile.

Remarks: Whitelegge's specimen is incomplete, the uropods, telson, and some of the limbs are missing. However, it is not possible to reconcile what remains with new material collected from the NSW shelf (*P. grevillea* and *P. epacris*). The species can be recongized by its narrow head, elongate articles on posterior pereopods and, according to Whitelegge (1901), the sharply tapering telson. Whitelegge's figure of the antennae is clearly in error.

Paranthura kunzea sp. nov.

Figures 16, 17

Material examined: 21 juveniles; 2.5-9.1 mm:

Holotype: juvenile, 9.1 mm, NMV J1646. Tas., Cape Portland (40°45'S, 147°57'E), G. Edgar, 6 Apr. 1980.

Paratypes: Tas., Cape Portland, G. Edgar; 6 Apr. 1980, NMV J1647(3 specimens); 11 Jan. 1981, NMV J1648(13), AM P32601(4).

Description: Juvenile. Head 0.9× as wide as long. Pleon 1.4× as long as pereonite 7, pleonites 1-6 free. Antenna 1 flagellum of 6 articles. Antenna 2 flagellum 0.7× as long as fifth article of peduncle.

Pereopod 1 article 6 elongate, 1.5× as long as wide; palm oblique (25°); proximal thumb broad, separated from the straight cutting edge by a shallow obtuse angle; setal formula 13, 13, 45. Pereopod 2 article 6 shorter than that of pereopod 1, 1.8× as long as broad, palm with 10 spines. Pereopod 4 articles 5 and 6 with 5 spines each; dactyl stout, 0.9× length of article 6. Pereopod 7 articles 5 and 6 with 4 and 5 spines respectively; article 6 3.5× as long as wide; dactyl stout, 0.7× length of article 6.

Pleopod 1 endopod bearing 8 setae; exopod widest in distal half and with rounded apex, bearing 21 setae. Pleopod 2 endopod 4× as long as broad, wih 6 setae distally; exopod with partial suture laterally, with 2 setae proximal to suture and 10 setae distally.

Uropodal endopod reaching little beyond end of telson, as long as wide, lateral margin strongly convex; exopod 2× as long as wide, proximal lobe as long as wide, parallel-sided for much of its length ending with an evenly rounded apex; with numerous terminal long setae and dorsal submarginal short setae on distal half.

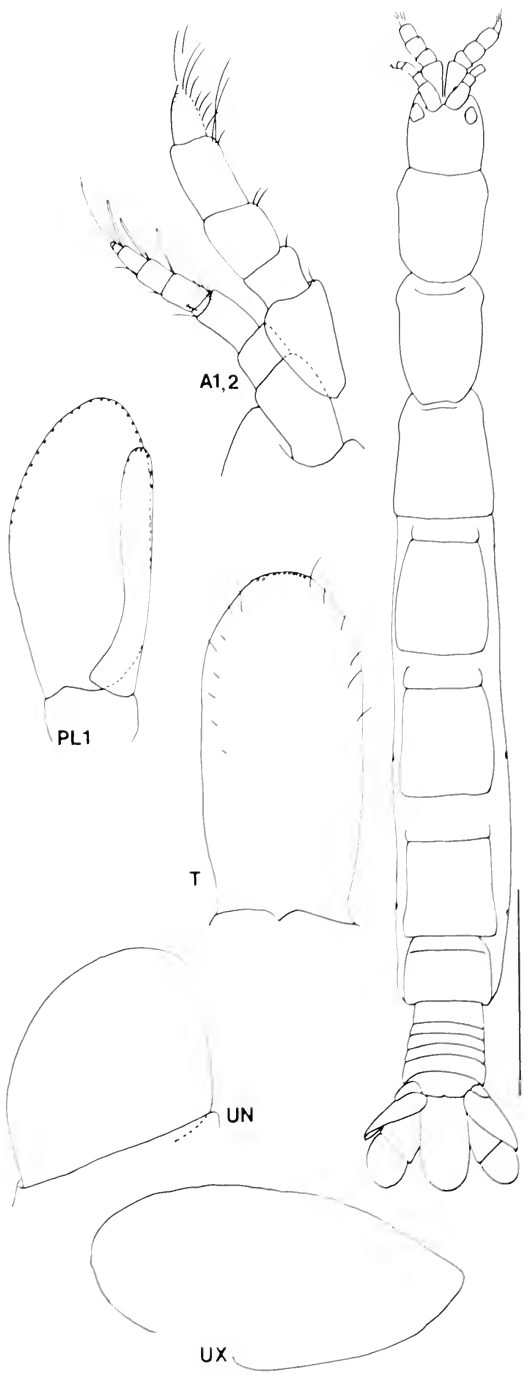

Figure 16. *Paranthura kunzea*. Holotype juvenile.

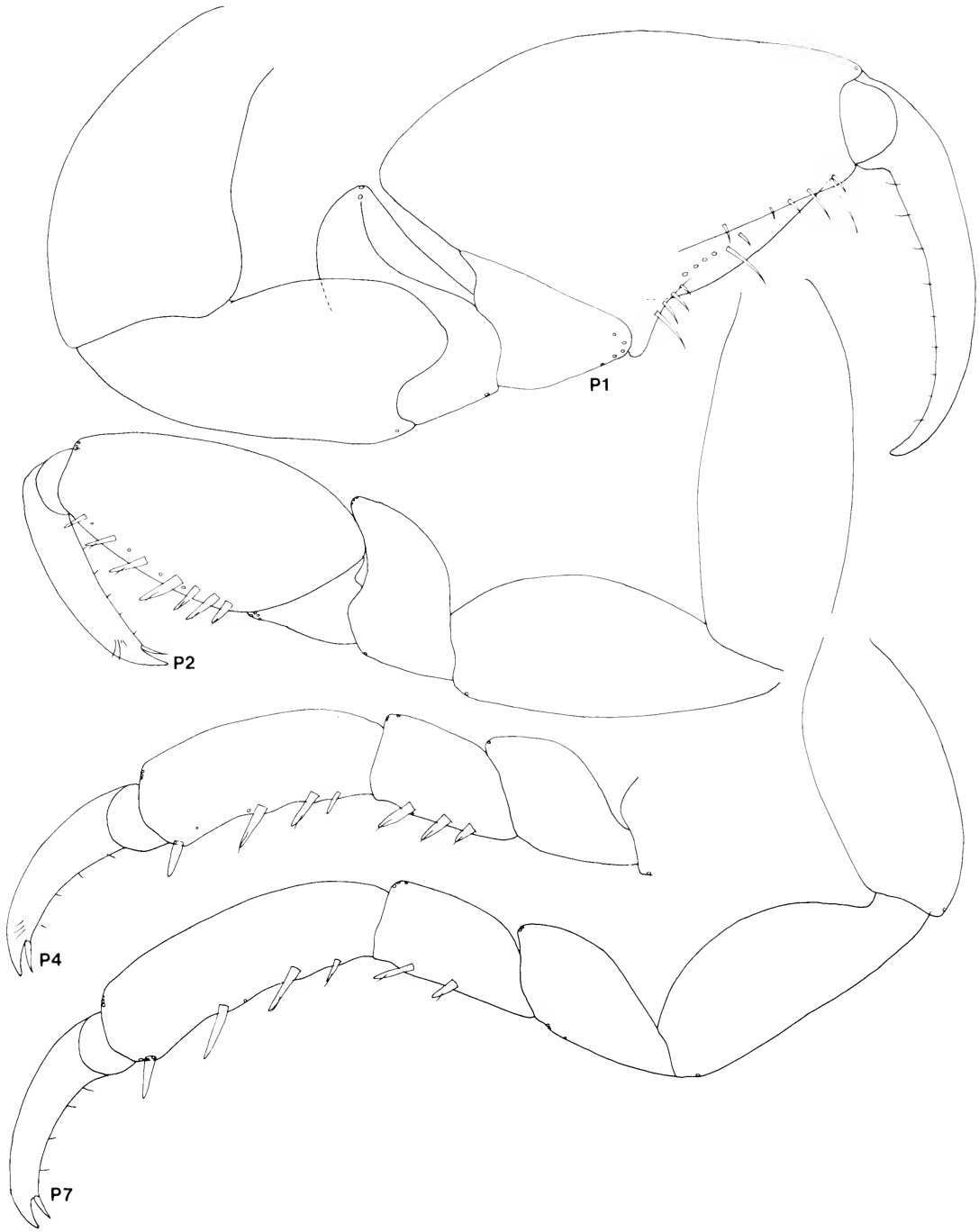

Figure 17. *Paranthura kunzea*. Holotype juvenile.

Male. Unknown.

Colour: Brown on head, only small patches elsewhere dorsally.

Distribution: Tasmania. Algae to 3 m.

Remarks: *Paranthura kunzea* is a moderately-sized species best recognised by its short, relatively broad telson and short pleon. The pereopods are relatively indistinguished.

Paranthura lobelia sp. nov.

Figures 18, 19

Material examined: 1 female, 3 males, 1 juvenile; 6.8-11.6 mm:

Holotype: female, 10.9 mm, AM P32602. NSW, Port Stephens, off Shoal Bay (32°41'S, 152°09'E), in coarse sand with *Posidonia australis*, 2.5 m, P. Gibbs, 1 Sep. 1976.

Paratypes: NSW, type-locality, AM P32603 (3 specimens), NMV J1556(1).

Description: Female. Head almost as wide as long. Pleon 1.5× as long as pereonite 7, pleonites 1-6 free. Antenna 1 flagellum of 9 articles. Antenna 2 flagellum 0.8× as long as fifth article of peduncle.

Pereopod 1 article 6 elongate, 1.6× as long as wide; palm axial (0°); proximal thumb very broad, separated from the convex cutting edge by a shallow obtuse angle; setal formula 13, 13, 45. Pereopod 2 article 6 shorter than that of pereopod 1, 1.8× as long as broad, palm with 10 spines. Pereopod 4 articles 5 and 6 with 5 spines each; dactyl stout, 0.9× length of article 6. Pereopod 7 articles 5 and 6 with 4 and 5 spines respectively; article 6 3.5× as long as wide; dactyl stout, 0.7× length of article 6.

Pleopod 1 endopod bearing 21 setae; exopod widest in distal half and with rounded apex, bearing 34 setae. Pleopod 2 endopod 3.5× as long as broad, with 9 setae distally; exopod with partial suture laterally, with 3 setae proximal to suture and 14 setae distally.

Uropodal endopod reaching to end of telson, 0.9× as long as wide, lateral margin strongly convex; exopod 2.1× as long as wide, proximal lobe narrowly rounded, distal lobe broad then steeply tapering. Telson 1.5× as long as pleon, 2.6× as long as wide, widest in proximal half and tapering gradually to a rounded apex; with

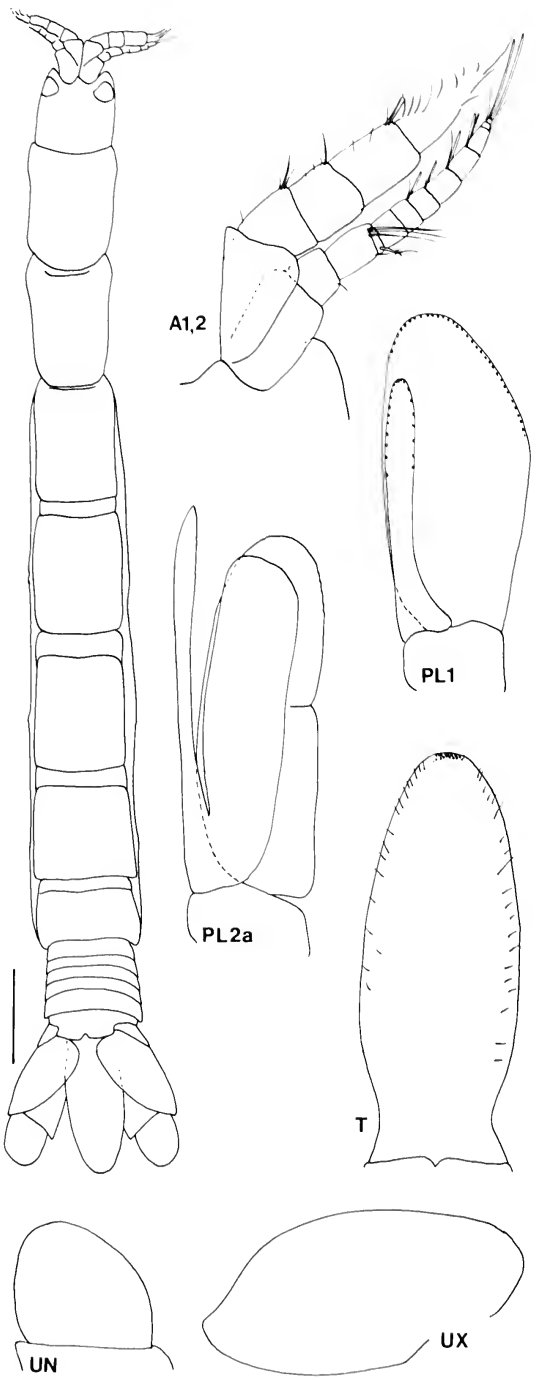

Figure 18. *Paranthura lobelia*. Holotype female; a, male, 11.6 mm, AM P32603.

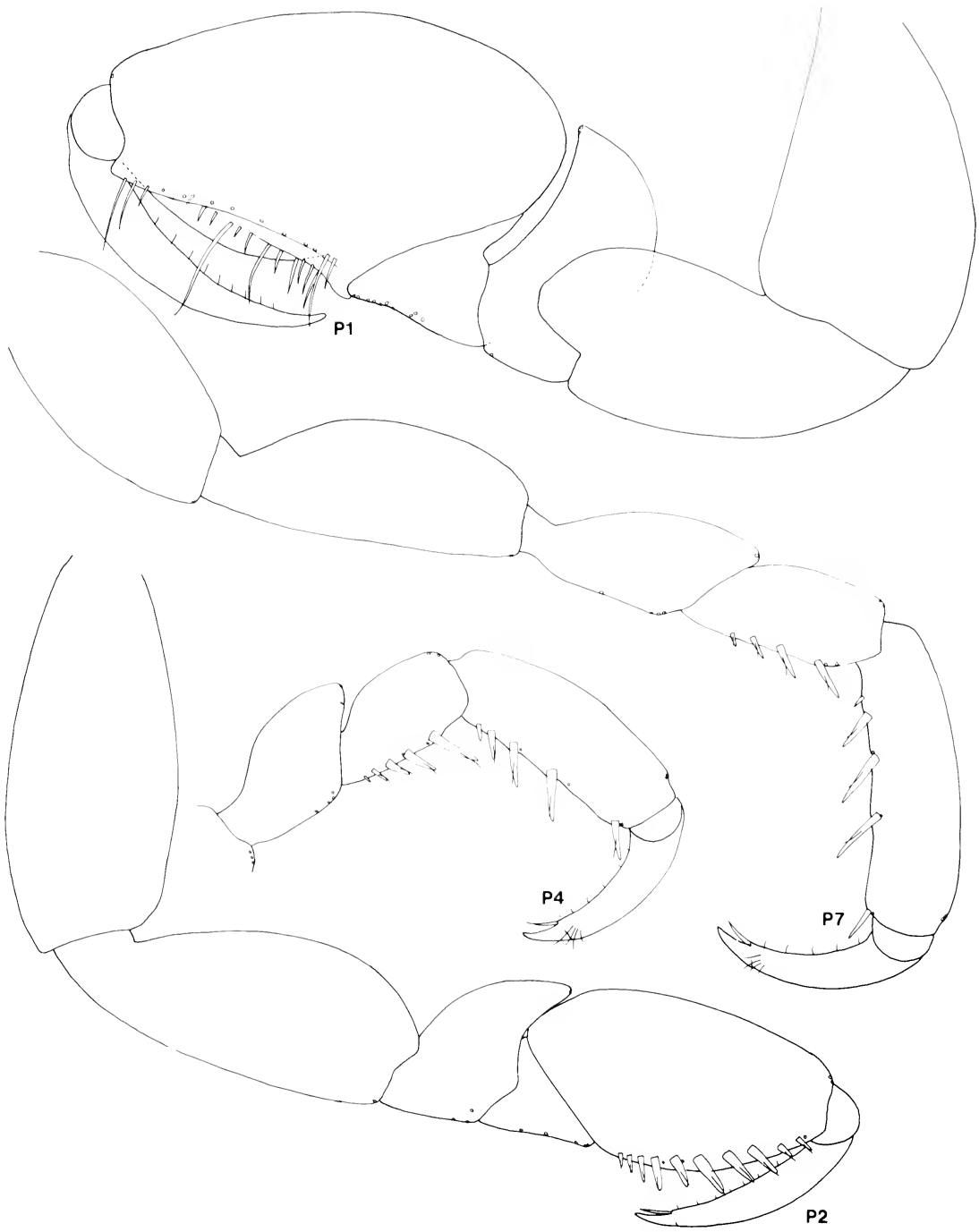

Figure 19. *Paranthura lobelia*. Holotype female.

numerous terminal long setae and dorsal submarginal short setae on distal two-thirds.

Male. Pereon and pleon of similar proportions to female; telson a little longer and dorsally setose. Antenna 1 with 8 aesthetasc-bearing articles. Pereopod 1 palm with about 50 mesial setae. Pereopod 2 article 6 more elongate. Pereopod 7 not modified. Uropodal rami of similar shape to female, exopod mesially setose. Pleopod 2 with a simple lanceolate appendix masculina, only just exceeding endopod.

Colour: Diffuse brown pigment dorsally.

Distribution: NSW (Port Stephens), subtidal.

Remarks: *Paranthura lobelia* is similar to *P. acacia* in the form of pereopod 1 but differs in having a shorter uropodal endopod, broader exopod, broader sixth articles on pereopods 4-7, and a more tapering telson. The species shares with *P. microtis* a distinctly tapering telson.

Paranthura microtis sp. nov.

Figures 20, 21

Paranthura punctata.—Barnard, 1925: 154 (part from South Australia).—Nierstrasz, 1941: 252 (part). [Not *Paranthura punctata* (Stimpson)—South Africa].

Material examined: 2 females, 3 males, 1 juvenile; 9.4-16.9 mm:

Holotype: female, 16.9 mm, SAM C3904. SA, St Vincent Gulf, 31 Jan. 1895.

Paratypes: SA, type-locality, SAM C3905 (1 male). Port Adelaide, Feb. 1907, NMV J1652(2) [labelled *Paranthura punctata* (Stimpson) = 'nigropunctata' of Australian zoologists sed non Lucas, determ. K. H. Barnard]. Sellicks Beach, "underside of smooth hard boulders on reef", H. M. Hale, 27 Jan. 1936, SAM C3909(2).

Description: Female. Head as wide as long. Pleon 2.0× as long as pereonite 7, pleonites 1-6 free. Antenna 1 flagellum of 10 articles. Antenna 2 flagellum 0.9× as long as fifth article of peduncle.

Pereopod 1 article 6 elongate, 1.6× as long as wide; palm axial (10°); proximal thumb broad, separated from the straight cutting edge by a shallow obtuse angle; setal formula 16, 15, 60. Pereopod 2 article 6 shorter than that of pereopod 1, 1.8× as long as broad, palm with 11 spines. Pereopod 4 articles 5 and 6 with 5 and 6 spines respectively; dactyl stout, 0.8× length of article 6. Pereopod 7 articles 5 and 6 with 5 and 6 fine spines respectively; article 6 4× as long as wide; dactyl stout, 0.7× length of article 6.

Pleopod 1 endopod bearing 40 setae; exopod widest in proximal half and tapering distally, bearing about 55 setae. Pleopod 2 endopod 2.8× as long as broad, with about 30 setae distally; exopod with partial suture laterally, with 4 setae proximal to suture and 16 setae distally.

Uropodal endopod reaching beyond end of telson, 1.1× as long as wide, lateral margin weakly convex; exopod 2.3× as long as wide, proximal lobe narrowly rounded, distal lobe rounded. Telson 1.5× as long as pleon, 2.4× as long as wide, widest in proximal half and tapering sharply to an evenly rounded apex; with numerous terminal long setae and dorsal submarginal short setae on distal half.

Male. Pereon of similar proportions to female. Pleon little shorter (1.6× pereonite 7), telson shorter (1.3× pleon) than in female. Antenna 1 with 6 aesthetasc-bearing articles. Pereopod 1 with about 40 mesial setae. Pereopod 2 article 6 more elongate. Pereopod 7 more elongate than female. Uropodal rami narrower, not especially setose. Pleopod 2 with a simple appendix masculina reaching well beyond endopod.

Colour: Very dark brown dorsally on pereon of some individuals, in distinct large chromatophores on telson and uropods.

Distribution: South Australia.

Remarks: *Paranthura microtis* is very close to *P. acacia* from Victoria. The pereopods of the two species are virtually indistinguishable. However, the rich colour of this species, the more broadly rounded uropodal endopod and the more sharply tapering telson serve to separate the two. Males of *P. acacia* and *P. microtis* differ in modification of pereopods and uropodal rami.

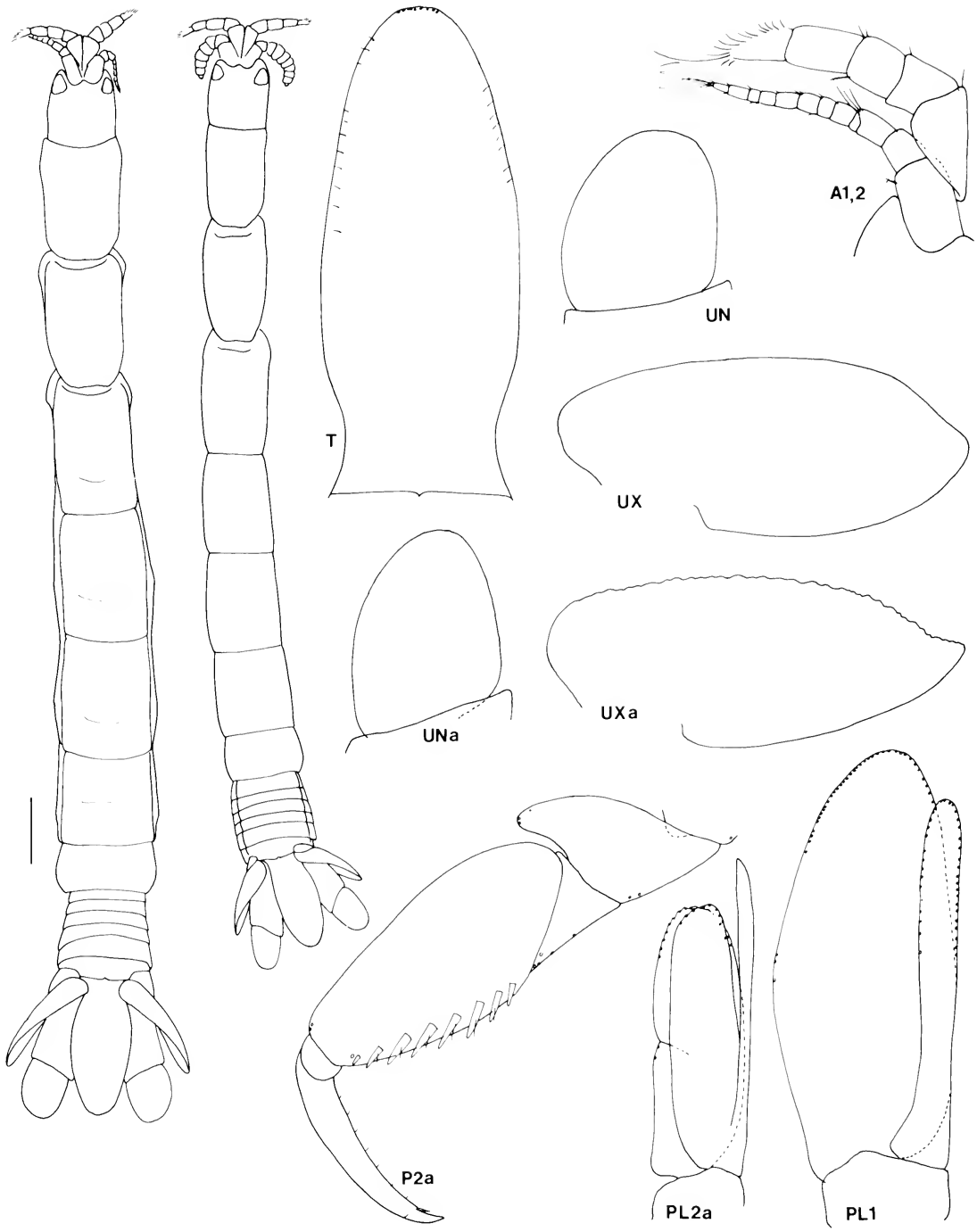

Figure 20. *Paranthura microtis*. Holotype female; a, male, 13.6 mm, SAM C3905.

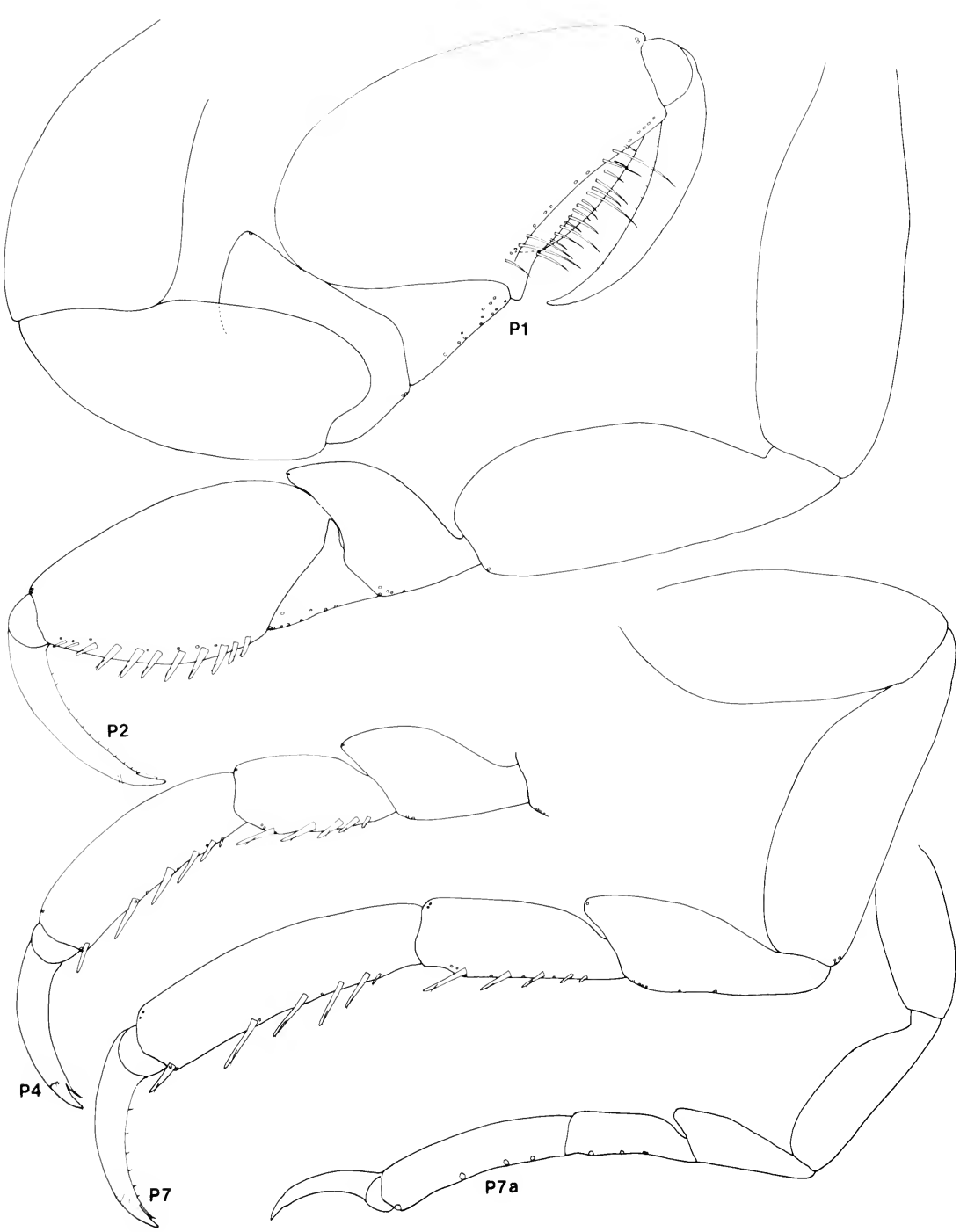

Figure 21. *Paranthura microtis*. Holotype female; a, male, 13.6 mm, SAM C3905.

Paranthura senecio sp. nov.

Figures 22, 23

Material examined: 3 males, 18 juveniles; 3.7-11.6 mm:

Holotype: juvenile, 8.7 mm, AM P33602. NSW, Jervis Bay, off Moona Moona Creek (35°00'S, 150°45'E), algae and sediment, 3 m, J. K. Lowry, 19 Jun. 1982 (stn NSW-115).

Paratypes: NSW, type-locality, AM P33603 (1 male), AM P32692 (1 male, 7 juveniles). Type-locality and date, on mussel *Trichomya hirsuta* with epizoic algae and sponges on sand-covered rocks, 8 m (stn NSW-113), NMV J3000 (1 male, 4 juveniles); encrusting sponge, 3 m (stn NSW-112), AM P32689(1); on alga *Zonaria*, small encrusting ascidian in *Ecklonia* bed, 3 m (stn NSW-114), AM P32691(5).

Description: Juvenile. Head about as wide as long. Pleon especially short, 1.4× as long as pereonite 7, wider than long, pleonites 1-6 free. Antenna 1 flagellum of 7 articles. Antenna 2 flagellum 0.5× as long as fifth article of peduncle.

Pereopod 1 article 6 globose, 1.5× as long as wide; palm oblique (20°); proximal thumb broad, separated from the straight cutting edge by a shallow obtuse angle; setal formula 14, 16, 29. Pereopod 2 article 6 shorter than that of pereopod 1, 1.8× as long as broad, palm with 9 spines. Pereopod 4 articles 5 and 6 each with 4 spines; dactyl moderately stout, 0.8× length of article 6. Pereopod 7 articles 5 and 6 each with 3 spines; article 6 4× as long as wide; dactyl fine, 0.6× length of article 6.

Pleopod 1 endopod bearing setae; exopod widest in proximal half and tapering distally, bearing 30 setae. Pleopod 2 endopod with 6 setae distally; exopod with partial suture laterally, with 1 seta proximal to suture and 12 setae distally.

Uropodal endopod reaching just beyond end of telson, about as long as wide, lateral margin strongly convex, exopod 1.3× as long as wide, proximal lobe broadly rounded, distal lobe acute and evenly tapering. Telson 2.1× as long as pleon, 2.6× as long as wide, widest proximally and tapering to very broadly rounded apex; with numerous terminal long setae and dorsal submarginal short setae on distal half.

Male. Pleon shorter and broader than in juvenile, telson more elongate. Antenna 1 with 5 aesthetasc-bearing articles. Pereopod 1 palm with about 60 mesial setae. Pereopod 2 article 6 more elongate. Pereopod 7 basis very broad, ovate; article 3 slightly broader than in juvenile. Uropodal rami slightly broader than in juvenile. Pleopod 2 with a hooked appendix masculina, well exceeding endopod.

Colour: Scattered dorsal pigment.

Distribution: NSW (Jervis Bay). Algae and encrusting epizoans, 3-8 m.

Remarks: *Paranthura senecio* is distinguished from other south-eastern Australian species mainly by its very short pleon of separate pleonites and oblique pereopod 1 palm.

Paranthura telopea sp. nov.

Figures 24, 25

Material examined: 1 male, 3 females, 15 juveniles, 2.5-6.0 mm:

Holotype: female, 5.0 mm, NMV J3002. Vic., 13 km W. of Lorne, intertidal, in tubes of polychaete *Galeolaria*, W. F. Seed, Jan. 1960.

Paratypes: Vic., type-locality, AM P33580(3); NMV J3003 (1 male). Aireys Inlet, among tubes of *Galeolaria*, W. F. Seed, Jan. 1967, NMV J3004(2); 28 Dec. 1967, NMV J3006(2). Cape Otway, W. F. Seed, Jan. 1959, NMV J3007(8), J3008(1).

Description: Female. Head as wide as long, not tapering. Pleon 1.6× as long as pereonite 7, very short, almost 2× as wide as long, pleonites 1-5 fused, 6 free; laterally with 5 long plumose setae. Antenna 1 flagellum of 3 articles. Antenna 2 flagellum 0.3× as long as fifth article of peduncle.

Pereopod 1 article 6 globose, 1.3× as long as wide; palm oblique (50°); proximal thumb acute, separated from the convex cutting edge by a deep acute angle; setal formula 4, 11, 9. Pereopod 2 article 6 smaller than that of pereopod 1, 1.7× as long as broad, palm with 5 spines. Pereopod 4 articles 5 and 6 each with 2 spines; dactyl stout, 0.8× length of article 6. Pereopod 7 articles 5 and 6 with 2 and 3 spines respectively; article 6 2.7× as long as wide; dactyl stout, 0.8× length of article 6.

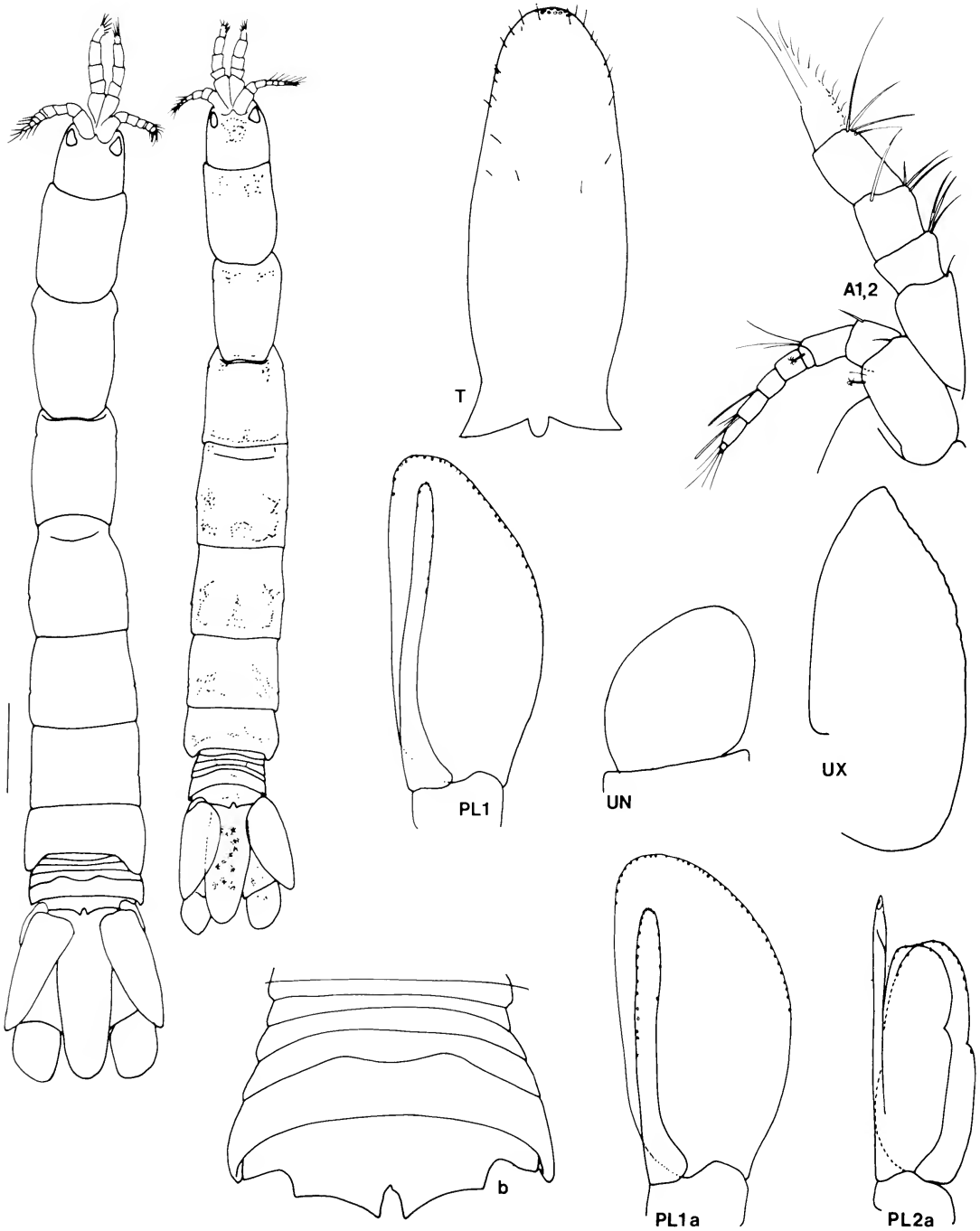

Figure 22. *Paranthura senecio*. Holotype juvenile; a, male, 11.6 mm, AM P33603; b, pleon of juvenile, 8.2 mm, AM P32692.

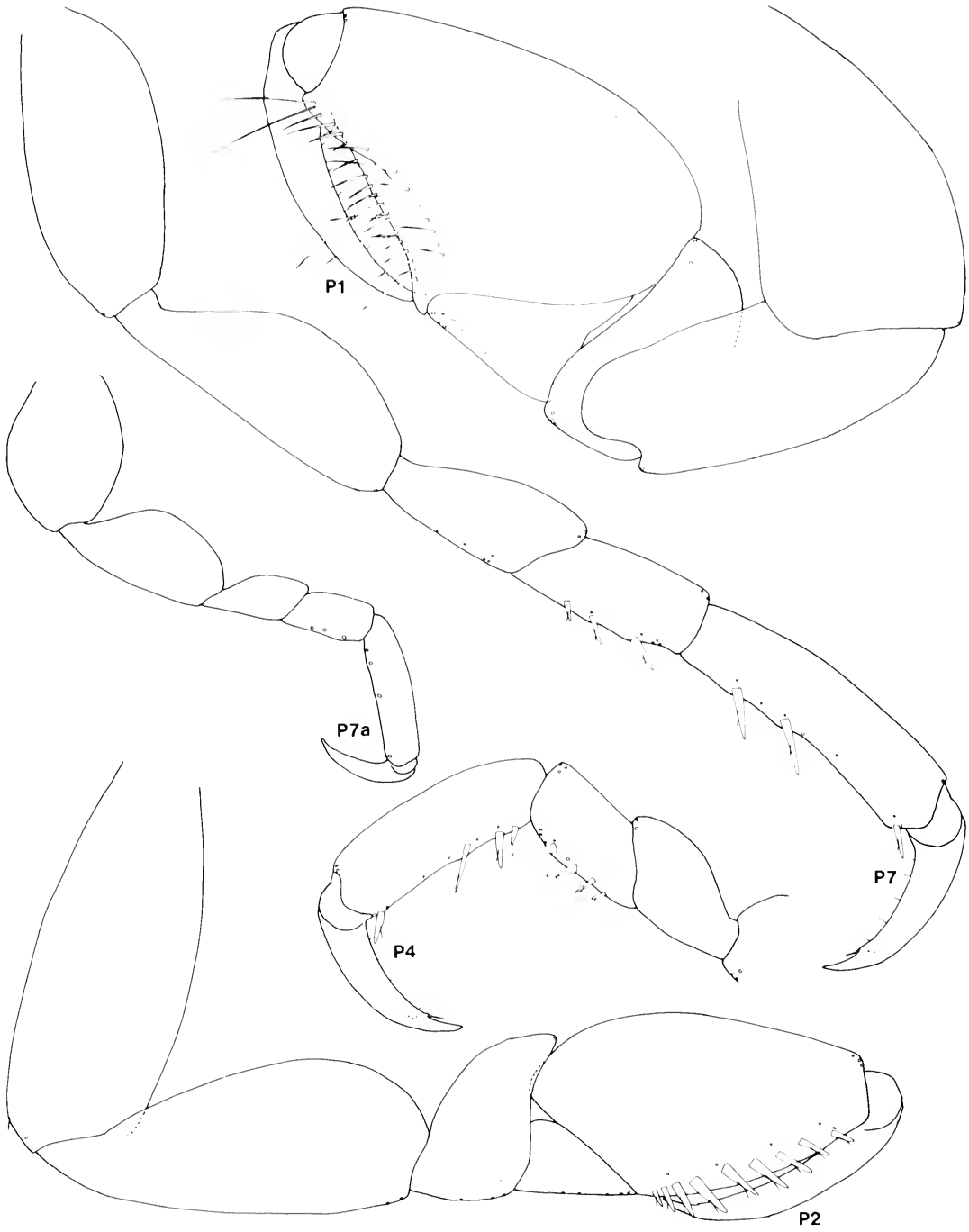

Figure 23. *Paranthura senecio*. Holotype juvenile; a, male, 11.6 mm, AM P33603.

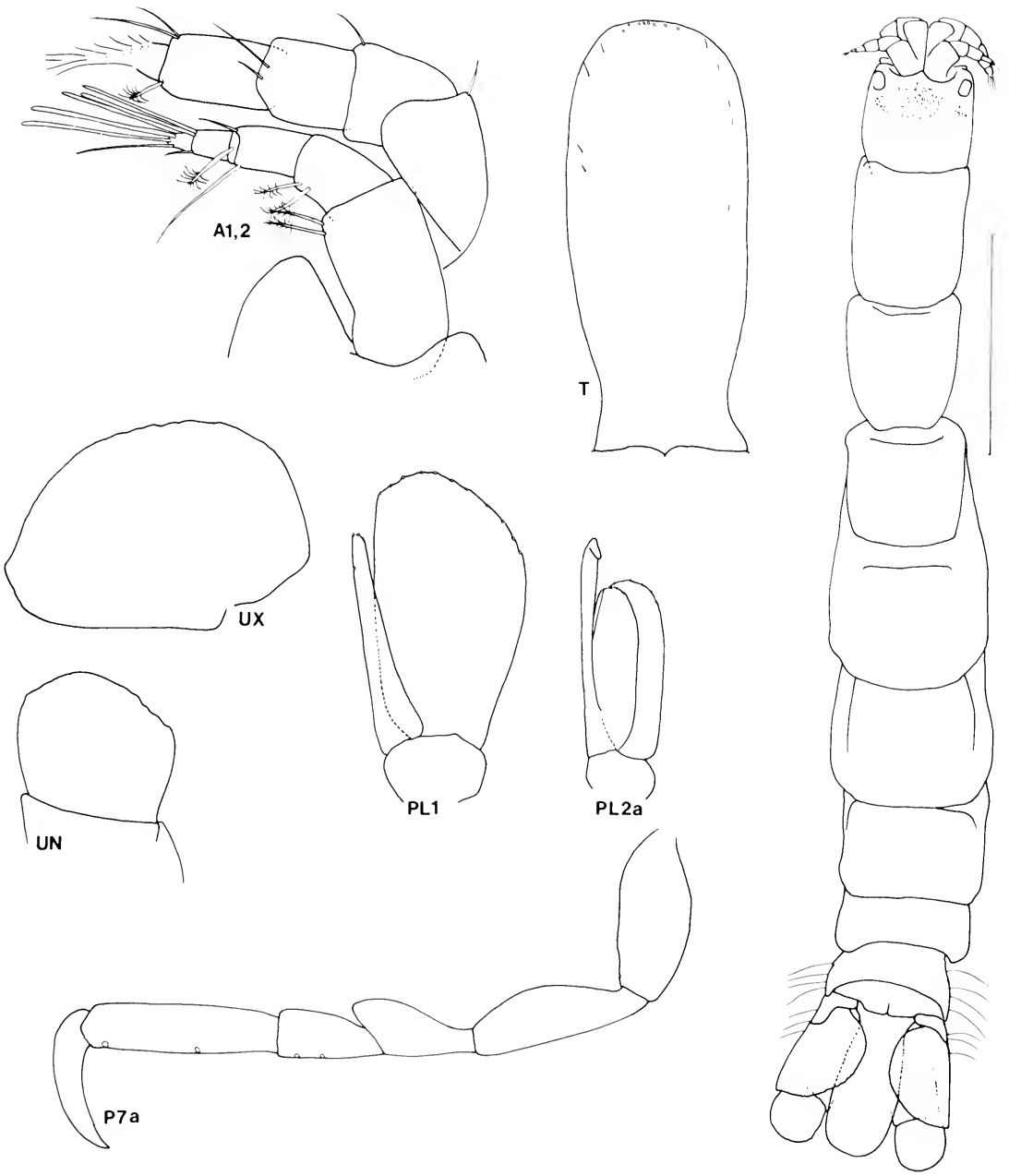

Figure 24. *Paranthura telopea*. Holotype female; a, male, 4.4 mm, NMV J3003.

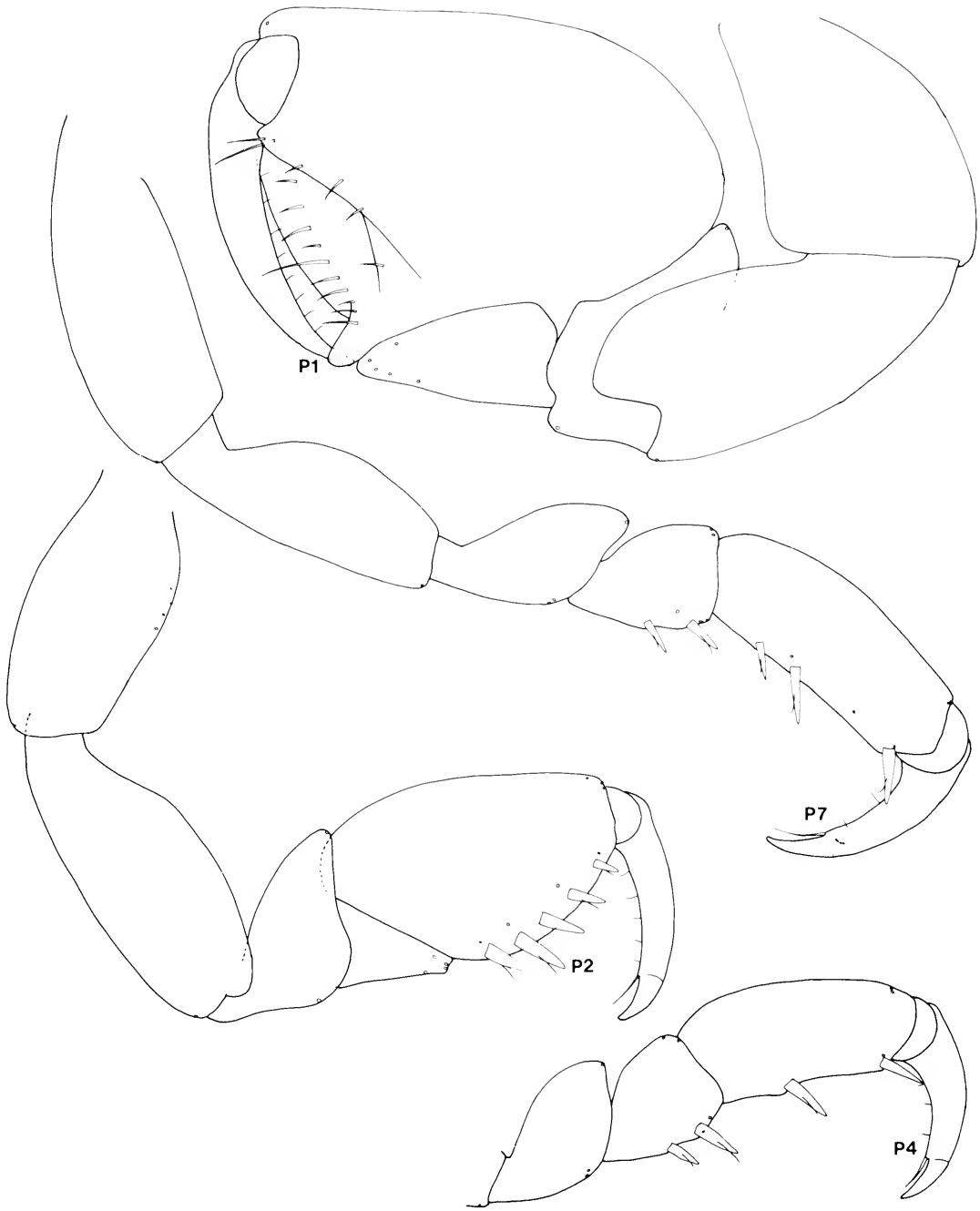

Figure 25. *Paranthura telopea*. Holotype female.

Pleopod 1 endopod bearing 4 setae; exopod widest in distal half and with rounded apex, bearing 11 setae. Pleopod 2 endopod 3× as long as broad, with 3 setae distally; exopod without a partial suture, with 9 setae distally.

Uropodal endopod reaching to end of telson, about as long as wide, lateral margin strongly convex; exopod 1.4× as long as wide, proximal lobe very broadly rounded, distal lobe extremely obtusely angled. Telson 2× as long as pleon, 2.4× as long as wide, widest distally and with a very broad rounded apex; with numerous terminal long setae and dorsal submarginal short setae on distal half.

Male. Pereopod of similar proportions to female. Pleon a little shorter (1.4× pereonite 7), and telson shorter (1.4× pleon). Antenna 1 with 4 aesthetase-bearing articles. Pereopod 1 palm with 22 mesial setae. Pereopod 2 article 6 more elongate than in female. Pereopods 4-7 with terminal articles more elongate. Uropodal rami narrower than in female. Pleopod 2 with a hooked appendix masculina, well exceeding the endopod.

Colour: Scattered patches of pigment dorsally, most notably on anterior part of head and on pleon.

Distribution: Victoria. Intertidal rocky shore.

Remarks: *Paranthura telopea* is one of the more easily recognised species of this genus from the area. Its compact form and fused pleonites immediately distinguish it from most other species. Another small coloured specimen from the Victorian coastline, *P. dryandra*, has a longer pleon of free segments.

Acknowledgements

This contribution was made possible through a grant from the Australian Biological Resources Study. I wish to thank Helen Lew Ton for sorting much of the material and preparation of many of the figures.

For the loan of material I am indebted to J. Lowry (Australian Museum, Sydney), W. Zeidler (South Australian Museum, Adelaide), and G. Hartmann and G. Hartmann-Schroeder (Zoologisches Museum, Universitat Hamburg).

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SYNOPSIS OF AUSTRALIAN PIPEFISHES USUALLY REFERRED TO THE SYNGNATHINE (TAIL-POUCH) GENERA *SYNGNATHUS, LEPTONOTUS* AND *HISTIOGAMPHELUS*

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Abstract

Twelve Australian species, usually referred to the syngnathine genera *Syngnathus* and *Leptonotus*, are referred to five genera (*Parasyngnathus, Vanacampus, Pugnaso, Kaupus, Mitotichthys*), and two species are recognized in the genus *Histiogamphelus*. Representatives of *Leptonotus* and *Syngnathus* are presently unknown from Australia. Treated taxa share the same configuration of principal body ridges (discontinuous lateral trunk and tail ridges, confluent inferior trunk and tail ridges), but differ in the morphology of the brood pouch, in the development of certain ridges on the head and in other features. *Parasyngnathus* Duncker (with opercular ridge, pouch plates, everted pouch closure) includes the type-species, *P. penicillus* (Cantor), a senior synonym of *P. argyrostictus* (Kaup), and *P. parvicarinatus* (Dawson). *Vanacampus* Whitley (with opercular ridge and semi pouch closure, without pouch plates) includes the type-species, *V. vercoi* (Waite and Hale), and three congeners, *V. margaritifer* (Peters), *V. phillipi* (Lucas) and *V. poecilolaemus* (Peters). The monotypic *Pugnaso* Whitley [type-species: *P. curtirostris* (Castelnau)] lacks the opercular ridge and pouch plates and has the semi pouch closure. *Kaupus* Whitley, also monotypic [type-species: *K. costatus* (Waite and Hale)], has an opercular ridge, pouch plates, everted pouch closure and a trunk that is exceptionally deep in adult females. *Mitotichthys* Whitley (without opercular ridge, with elevated dorsal-fin base, with or without vestigial pouch plates, with everted pouch closure) includes the type-species, *M. tuckeri* (Scott), and *M. semistriatus* (Kaup), as well as two poorly known species, *M. meraculus* (Whitley) and *M. mollisoni* (Scott), that are included provisionally. *Histiogamphelus* McCulloch (with elevated snout ridge and dorsal-fin base, without opercular ridge, with or without vestigial pouch plates, with everted pouch closure) includes the type-species, *H. briggsii* McCulloch, and *H. cristatus* (Macleay). *Parasyngnathus penicillus* (Arabian Gulf to Japan) and the endemic Australian *P. parvicarinatus* are mainly restricted to the northern half of the Australian mainland. The remaining taxa are restricted to Tasmania and the southern half of the Australian mainland. Complete synonymies, diagnoses, keys to genera and species, and data on variation and distribution are provided; all species, except *Mitotichthys mollisoni*, are illustrated.

Gilbert Whitley, in several reports published during the years 1940-51, proposed a number of new genera, subgenera, and other nomenclatural changes for some Australian pipefishes historically referred to the syngnathine (tail-pouch) genera *Syngnathus* Linnaeus and *Leptonotus* Kaup. Some of these changes were incorrect, his new genera and subgenera were not diagnosed adequately, and Whitley's proposals have been overlooked or ignored by most subsequent workers. As a result, the most recent general treatment of Australian pipefishes (Munro, 1958) refers 16 nominal species to the genus *Syngnathus* and 3 to *Leptonotus*. Among those included in *Syngnathus*, four names (*S. parviceps, S. wardi, S. conspicillatus, S. sauvagei*) have since been placed in synonymy (Dawson, 1977, 1978a, 1978b), *S. pelagicus* Linnaeus is unknown from Australia, and *S. superciliaris* Günther is a junior synonym of *Filicampus tigris* (Castelnau). Dawson (1978b) also synonymized *Leptonotus caretta* with *Syngnathus curtirostris* Castelnau, and described *S. parvicarinatus* as a new species from Australia. I here treat the 11 nominal Australian species currently referred to *Syngnathus*, as well as the remaining species and subspecies referred to *Leptonotus* and *Histiogamphelus* McCulloch by Munro (1958). All but one of these are endemic to Australia, all have the same configuration of principal body ridges, and none are referable to either *Leptonotus* or *Syngnathus* sensu stricto.

This synopsis, based on the majority of known specimens, resurrects several of Whitley's genus or subgenus names for the accommodation of species incorrectly referred to *Syngnathus* and *Leptonotus*. Relationships of these Australian species groups are, in part, uncertain, and some (e.g. *Pugnaso* and *Vanacampus*) may eventually prove to be congeneric. Similarly, the generic placement of some species, presently known only from the original description or a few poorly preserved

specimens, is provisional. Nevertheless, this report summarizes pertinent information on treated taxa, resolves a number of nomenclatural and taxonomic problems, and should provide a useful foundation for future studies.

Generic Characters

Although treated Australian genera are distinguished in the key and diagnoses, remarks on some characters distinguishing *Leptonotus* and *Syngnathus* from these taxa are appropriate here.

Pouch closure: Herald (1959) showed that the lateral membranous folds enclosing the eggs of brooding males of syngnathine genera exhibit different types of closure along the ventral midline of the brood pouch. In *Syngnathus*, the pouch closure is the inverted type (Fig. 1), wherein the lateral folds meet on the midline and extend dorsad within the egg-filled pouch. In *Leptonotus*, and four of the genera treated here, pouch closure is the everted type, wherein the membranous folds overlap and fold outward on the ventral surface of the pouch. The two remaining Australian genera have the semi type of closure, wherein the folds merely meet or nearly meet on the midline of the egg-filled pouch.

Pouch plates: Brood-pouch plates (ventrolateral extensions of sides of brood-pouch rings in adult males) are well developed in *Syngnathus* but obsolete in *Leptonotus*. Among genera treated here, pouch plates are well developed in *Parasyngnathus* and *Kaupus*, but vestigial or obsolete in the remainder.

Principal body ridges: In the Australian taxa, as well as *Leptonotus* and *Syngnathus*, the superior trunk and tail ridges are discontinuous near the rear of the dorsal-fin base, and inferior trunk and tail ridges are confluent. *Leptonotus*, known from New Zealand and South America (below ca. 23°S), is characterized by having the lateral trunk ridge confluent with the lateral tail ridge (Fig. 2a), a configuration that is not typical of any known Australian syngnathine pipefish. Except for some European and N. Pacific species wherein the lateral trunk and tail ridges are sometimes confluent, these ridges are typically discontinuous (Fig. 2b) in *Syngnathus*.

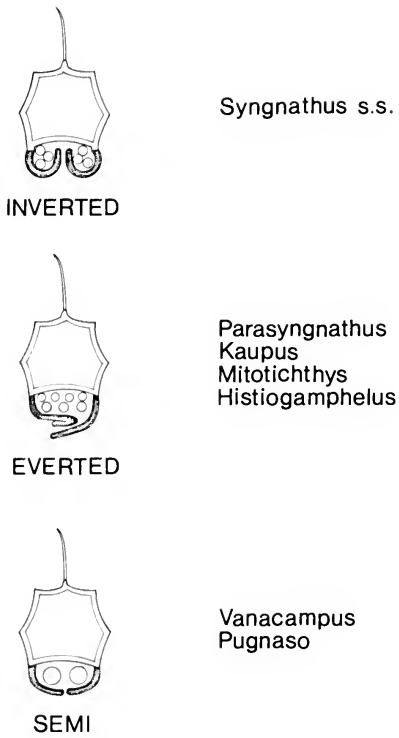


Figure 1. Cross-sectional diagrams of tail of brooding males illustrating types of brood-pouch closure occurring in *Syngnathus* s. s. and treated genera of Australian pipefishes.

This configuration is shared with a number of syngnathine genera, including those treated here and three others occurring in Australia (*Corythoichthys, Cosmocampus, Hypselognathus*) which have been discussed by Dawson (1977, 1980) and Dawson and Glover (1982). A similar configuration occurs in *Hippichthys* Bleeker, also represented in Australia (Dawson, 1978a), but, in this case, the lateral trunk ridge is deflected ventrad to end just above the inferior ridge.

Opercular ridge: Although usually present in early juveniles, a distinct opercular ridge (Fig. 3) is lacking in subadults-adults of *Leptonotus, Syngnathus* and three of the present genera (*Pugnaso, Mitotichthys, Histiogamphelus*); in the others (*Parasyngnathus, Vanacampus, Kaupus*), this ridge is distinct and often completely crosses the opercle.

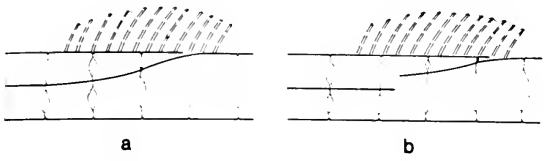


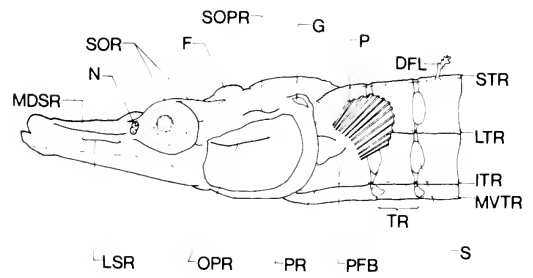
Figure 2. Configuration of principal body ridges in: (a)—*Leptonotus* and (b)—*Syngnathus* and treated Australian genera.

In summary, treated Australian genera are readily differentiated from *Syngnathus* s. s. by differences in type of pouch closure, and from *Leptonotus* by their different configuration of principal body ridges.

Methods and Materials

Measurements are in millimetres (mm) and are referred to head length (HL), standard length (SL) or total length (TL). Counts of trunk rings begin with that bearing the pectoral-fin base (pectoral ring) and end with that bearing the anus (anal ring). Tail ring counts begin with the 1st ring behind the anus (usually bearing the anal fin) and end with the penultimate ring, excluding the terminal element bearing the caudal fin. Subdorsal rings are estimated in ¼-ring intervals before and behind the anterior margin of the 1st tail ring (0-point); these data have been grouped in 0.75-ring intervals (Tables 6-8). All fin-rays are counted separately. Other methods follow Dawson (1977). Morphological features mentioned in text are illustrated (Fig. 3). Colour descriptions are from specimens preserved in alcohol. As used here, the term "venter" is synonymous with the ventral surface of head or body. Distributions are largely based on material examined; depth is in metres (m). Synonymies are intended to be complete but some references may have been omitted inadvertantly. Diagnoses of genera are based largely on characters of subadults-adults. Keys to genera and species are designed for the identification of late juvenile-adult specimens, and characters requiring determination of sex, state of maturity, or preserved colouration have been kept to a minimum.

Abbreviations for repositories of material examined are: AMNH—American Museum of Natural History, New York; AMS—Australian Museum, Sydney; ANSP—Academy of Natural Sciences of Philadelphia; BMNH—British Museum (Natural History), London; BPBM—Bernice P. Bishop Museum, Honolulu; CAS—California Academy of Sciences, San Francisco; CAS-SU—former Stanford Univ. material now at CAS; CSIRO—CSIRO Fisheries Laboratory, Cronulla; FMNH—Field Museum of Natural



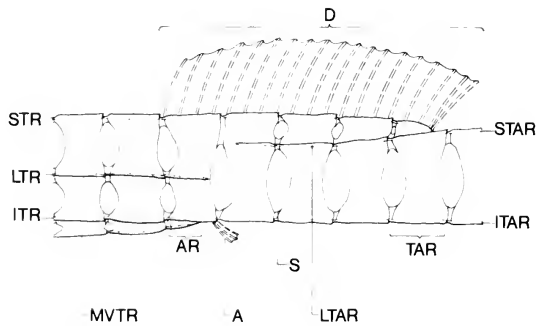


Figure 3. Lateral sections of a generalized pipefish delineating principal morphological features referenced in text. A—anal fin; AR—anal ring; D—dorsal fin; DFL—dermal flap; F—frontal ridge; G—gill opening; ITAR—inferior tail ridge; ITR—inferior trunk ridge; LSR—lateral snout ridge; LTAR—lateral tail ridge; LTR—lateral trunk ridge; MDSR—median dorsal snout ridge; MVTR—median ventral trunk ridge; N—naris; OPR—opercular ridge; P—pectoral fin; PFB—pectoral-fin base; PR—pectoral ring; S—scutellum; SOPR—supraopercular ridge; SOR—supraorbital ridge; STAR—superior tail ridge; STR—superior trunk ridge; TAR—tail ring; TR—trunk ring.

History, Chicago; GCRL—Gulf Coast Research Laboratory Museum; KFRS—Kanudi Fisheries Research Station, Papua New Guinea; MCZ—Museum of Comparative Zoology, Harvard University; MNHN—Muséum National d'Histoire Naturelle, Paris; NMV—National Museum of Victoria, Melbourne; NTM—Northern Territory Museum, Darwin; QM—Queensland Museum, Brisbane; QVM—Queen Victoria Museum and Art Gallery, Launceston; RMNH—Rijksmuseum van Natuurlijke Historie, Leiden; ROM—Royal Ontario Museum, Toronto; SAM—South Australian Museum, Adelaide; SMNS—Staatliches Museum für Naturkunde Stuttgart; TFDA—Tasmanian Fisheries Development Authority, Hobart; TM—Tasmanian Museum, Hobart; UM—University of Melbourne; UMMZ—University of Michigan Museum of Zoology, Ann Arbor; USNM—National Museum of Natural History, Smithsonian Institution, Washington, D.C.; WAM—Western Australian Museum, Perth; YCM—Yokosuka City Museum, Japan; ZMB—Zoologisches Museum, Museum für Naturkunde der Humboldt-Universität, Berlin.

KEY TO AUSTRALIAN GENERA OF SYNGNATHINE (TAIL-POUCH) PIPEFISHES WITH DISCONTINUOUS LATERAL TRUNK AND TAIL RIDGES AND CONFLUENT INFERIOR RIDGES

1a. Lateral trunk ridge straight (Fig. 4a) 2
1b. Lateral trunk ridge deflected ventrad near anal ring (Fig. 4b) ..... *Hippichthys* Bleeker*
2a. Snout slender in lateral aspect, the median dorsal ridge not elevated to or above horizontal through dorsal rim of orbit 3
2b. Snout deep in lateral aspect, the median dorsal ridge elevated to or above horizontal through dorsal rim of orbit ..... *Histiogamphelus* McCulloch
3a. Opercular ridge vestigial or absent in subadults-adults 4
3b. Opercular ridge typically distinct in subadults-adults 6
4a. Snout long, its length 1.3-2.1 in HL 5
4b. Snout short, its length 2.5-3.0 in HL ..... *Pugnaso* Whitley
5a. Snout essentially cylindrical; trunk rings 19-23; dorsal-fin base somewhat elevated ..... *Mitotichthys* Whitley

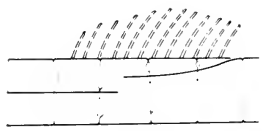


Fig. 4a

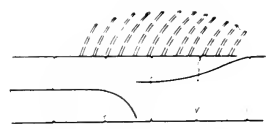


Fig. 4b

5b. Snout strongly compressed laterally; trunk rings 24-28; dorsal-fin base not elevated ..... *Hypselognathus* Whitley*
6a. Without lateral snout ridge or dermal flaps 7
6b. With lateral snout ridge and/or dermal flaps ..... *Cosmocampus* Dawson*
7a. Subdorsal trunk rings <3.5; trunk not exceptionally deep in adult females 8
7b. Subdorsal trunk rings >4.0; trunk exceptionally deep in adult females ..... *Kaupus* Whitley
8a. Pectoral-fin rays usually 13-18 (in 99% of specimens examined), modally 14-16 9
8b. Pectoral-fin rays usually 8-13 (in 99%), modally 9-12 ..... *Vanacampus* Whitley
9a. Anal-fin rays 2-3; pouch plates present ..... *Parasyngnathus* Duncker
9b. Anal-fin rays 4; pouch plates absent ..... *Corythoichthys* Kaup*

* Not treated here.

Parasyngnathus Duncker

Parasyngnathus Duncker, 1915: 79 [as subgenus of *Syngnathus* Linnaeus; type-species by original designation: *Syngnathus argyrostictus* Kaup, 1856 (=*S. penicillus* Cantor, 1849)].

Diagnosis: Median dorsal snout ridge low, not a high plate-like process extending above a horizontal through dorsal rim of orbit, usually terminating on anterior third of interorbital; supraopercular ridge usually present, sometimes obsolete; opercle typically with a complete, straight, longitudinal ridge; dorsum of trunk and tail essentially flat; principal body ridges distinct but not clearly elevated; superior trunk ridge not arched dorsad on subdorsal rings; usually with two ridges on pectoral-fin base; scutella with or without longitudinal keel-like ridges; dorsal-fin origin behind middle of last trunk ring, usually on tail, the fin-base not

elevated; trunk rings 15-17; total rings 51-57; dorsal-fin rays 23-31; total subdorsal rings 5.0-6.5; pectoral-fin rays 14-18; anal-fin rays 2-3; trunk depth of adult females little greater than that of adult males; pouch plates present; pouch closure the everted type (Fig. 1).

Comparisons: The combination of a complete opercular ridge, 14-18 pectoral-fin rays, everted pouch closure, presence of pouch plates, and absence of elevated snout ridge and dorsal-fin base distinguishes *Parasyngnathus* from other genera treated here.

Remarks: Duncker (1915) introduced *Parasyngnathus* as a subgenus of *Syngnathus* Linnaeus and later (1940) stated that this was the only subgenus of *Syngnathus* occurring in the Red Sea and tropical Indo-Pacific region. Whitley (1943), without comment, treated *Parasyngnathus* as a genus and incorrectly designated *Syngnathus spicifer* Rüppell (= *Hippichthys spicifer*) as the type-species. Whitley's treatment was not accepted by most subsequent workers, but the generic rank of *Parasyngnathus* was reaffirmed by Dawson (1981a). Duncker (1915) included two species groups with different principal body ridge configurations in *Parasyngnathus*, and one of these, including three species, was referred to the genus *Hippichthys* Bleeker by Dawson (1978a). Among the 12 other nominal species originally included by Duncker, three (*S. poecilolaemus, S. phillipi, S. margaritifer*) are here referred to *Vanacampus* Whitley, two (*S. kaupi, S. ansorgii*) were referred to *Enneacampus* by Dawson (1981b), and *Syngnathus analicarens* Duncker was referred to *Bryx* Herald by Dawson (1981a). I remain uncertain as to the status of *Syngnathus macrophthalmus* Duncker from the Red Sea, but four names, considered as doubtful species by Duncker (1915), are now in synonymy or referred to other genera: *S. modestus* Sauvage (= *Vanacampus poecilolaemus*), *S. flavescens* Kaup (= *S. abaster* Risso), *S. fasciolatus* Duméril and *S. uncinatus* Weber (both = *Bhanotia fasciolata*).

Parasyngnathus appears to be most closely related to the genus *Hippichthys* Bleeker from which is differs principally in the configuration of the lateral trunk ridge (Figs. 4a-b). Species of these taxa are similar in gross morphology, most appear to be euryhaline, and all are restricted to the Indo-Pacific region. *Parasyngnathus* could well be treated as a subgenus of *Hippichthys*, but generic rank is retained pending further study of higher relationships within the Syngnathidae. As understood here, *Parasyngnathus* includes *P. penicillus*, widely distributed in the tropical-subtropical Indo-Pacific region, and an endemic Australian species, *P. parvicarinatus*.

KEY TO THE SPECIES OF *PARASYNGNATHUS*

1a. Snout long, its length 1.5-2.4 in HL; snout depth usually more than 3 in snout length; trunk rings modally 16; scutella typically without keel-like ridges in subadults-adults (Fig. 5a) ..... *penicillus*

1b. Snout short, its length 3.0-3.3 in HL; snout depth usually less than 2 in snout length; trunk rings modally 15; scutella typically with keel-like ridges in subadults-adults (Fig. 5b) ..... *parvicarinatus*

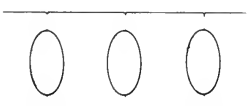


Fig. 5a

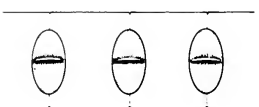


Fig. 5b

Parasyngnathus penicillus (Cantor)

Figure 6, Plate 1

Syngnathus penicillus Cantor, 1849: 1368 (orig. descr.; Sea of Pinang); Bleeker, 1853: 6 (listed); Bleeker, 1858a: 13 (listed); Duméril, 1870: 549 (descr. compiled); Günther, 1870: 171 (descr.); Duncker, 1904: 188 (listed); Duncker, 1915: 84 (= *S. argyrostictus*); Fowler, 1938: 99 (compiled; references, in part).

Syngnathus argyrostictus Kaup, 1853: 231 (nomen nudum); Kaup, 1856: 33 (orig. descr.; Java); Bleeker, 1858b: 448 (listed); Bleeker, 1859: 187 (listed); Duméril, 1870: 542, 545 (in key, descr.); Duncker, 1910: 32 (descr.; Malay Peninsula, China, Japan); Weber and de Beaufort, 1922: 79, 82 (in key, synon., descr., distr.); Hora, 1925: 461, Pl. 11, Fig. 6 (Madras, Goa); Reeves, 1927: 7

(listed); Chen, 1935: 7 (in key, synon. in part, descr.; Hong Kong); Herald, 1943: 39 (everted pouch closure); Chen, 1952: 306 (compiled); Matsubara, 1955: 426 (in key); Kamohara, 1957: 8 (colour note, Japan); Herald, 1959: 468 (everted pouch closure); Chen, 1960: 197 (descr.; Quemoy); Kamohara, 1964: 23 (Atsumi Bay, Japan to Formosa and Malaya); Kamohara and Yamakawa, 1965: 6 (Matsubara, Tekuzuky and Sōmachi, Japan); Lindberg and Legeza, 1965: 264 (in key, absent from Sea of Japan); Shiino, 1972: 62 (compiled); Tomiyama, 1972: 5 (refs., descr.; Mae-jima and Takamoku-jima, Japan); Dawson, 1978a: 133 (name only); Dawson, 1978b: 291 (compared with *S. gazella* and *S. parvicarinatus*); Jayaram, 1981: 304 (in Key, distr.).

Syngnathus biserialis Kaup, 1853: 232 (nomen nudum); Kaup, 1856: 33 (orig. descr., "probably = *S. argyrostictus*," India); Duncker, 1915: 84 (= *S. argyrostictus*).

Corythoichthys penicillus. Bleeker, 1859: 186 (n. comb., listed); Bleeker, 1861: 69 (compiled).

Syngnathus spicifer (not of Rüppell) Günther, 1870: 172 (in part, holotype of *S. biserialis* only).

Syngnathus altirostris Ogilby, 1890: 55 (orig. descr.; Moreton Bay, Qld. and Clarence River, N.S.W.); Waite, 1904: 18 (listed); Duncker, 1909: 244 (diagn.); McCulloch, 1929: 86 (compiled); Munro, 1958: 84, Fig. 581 (characters); Marshall, 1964: 114, Pl. 26, Fig. 122a-b (synon., descr., entering and living in freshwater); Marshall, 1966: 176, Pl. 26, Fig. 122a-b (colour note, distr.); Lake, 1971: 28 (distr., essentially marine but enters freshwater); Shiino, 1976: 109 (compiled); Parker, 1980: 193 (occasionally in freshwater in northern N.S.W. rivers).

Corythroichthys quinquarius Snyder, 1911: 526 (orig. descr.; Tanegashima, Japan); Snyder, 1912: 408, Pl. 52, Fig. 1 (notes; Tanegashima); Jordan et al., 1913: 97 (compiled, Kagoshima); Duncker, 1915: 84 (= *S. argyrostictus*); Okada, 1938: 158 (compiled); Kamohara, 1954: 269 (colour note; Takarajima).

Syngnathus (*Parasyngnathus*) *argyrostictus*. Duncker, 1915: 79, 84 (n. comb., type-species of *Parasyngnathus*, synon., descr., distr.); Palmer, 1954: 28 (listed, Singapore).

Corythoichthys altirostris. McCulloch, 1921: 36 (n. comb., in key); McCulloch and Whitley, 1925: 137 (compiled); McCulloch, 1929: 86 (compiled).

Parasyngnathus altirostris. Whitley, 1943: 177 Fig. 8 (n. comb., lectotype selection, descr., distr.); Whitley, 1956: 40 (listed); Whitley and Allan, 1958: 59 (distr., entering freshwater); Whitley, 1964: 37 (listed).

Hippichthys gazella Whitley, 1947: 148 (orig. descr.; Broome, W.A.); Anon., 1963: 35 (listed).

Parasyngnathus gazella. Whitley, 1948a: 268, Fig. 5 (n. comb., descr., comparisons); Whitley, 1948b: 14 (compiled); Whitley and Allan, 1958: 59, Fig. (listed); Whitley, 1964: 38 (listed).

Syngnathus gazella. Munro, 1958: 84, Fig. 580 (n. comb., characters; W.A.); Dawson, 1978b: 291, Fig. 1 (characters, comparisons, possibly = *S. argyrostictus*).

Parasyngnathus argyrostictus. Dawson, 1981a: 90, Figs. 3-4 (n. comb., descr., comparisons, distr.).

Diagnosis: Trunk rings modally 16; snout length 1.5-2.4 in HL; scutella without keel-like ridges in subadults-adults.

Description: Rings 15-17 + 35-41 (usually 16 + 38-40 in Australia); dorsal-fin rays 23-31 (usually 26-29 in Australia); dorsal-fin origin between posterior half of last trunk ring and posterior fourth of 2nd tail ring, usually on tail; total subdorsal rings 5.0-7.25; pectoral-fin rays 14-18, see Tables 1-8 for additional counts. Proportional data, based on 60 Australian specimens, 59.0-172.0 ($\bar{x}$ = 116.5) mm SL, follow: HL in SL 5.6-8.0 (6.7), snout length in HL 1.5-2.2 (1.8), snout depth in snout length 3.3-7.8 (5.7), length of dorsal-fin base in HL 1.3-2.0 (1.7), anal ring depth in HL 3.7-6.2 (4.9), trunk depth in HL 2.4-4.1 (3.4), pectoral-fin length in HL 6.4-9.5 (8.0). Scutella without longitudinal keel-like ridges in subadults-adults, poorly defined keels infrequently present in specimens < 80 mm SL.

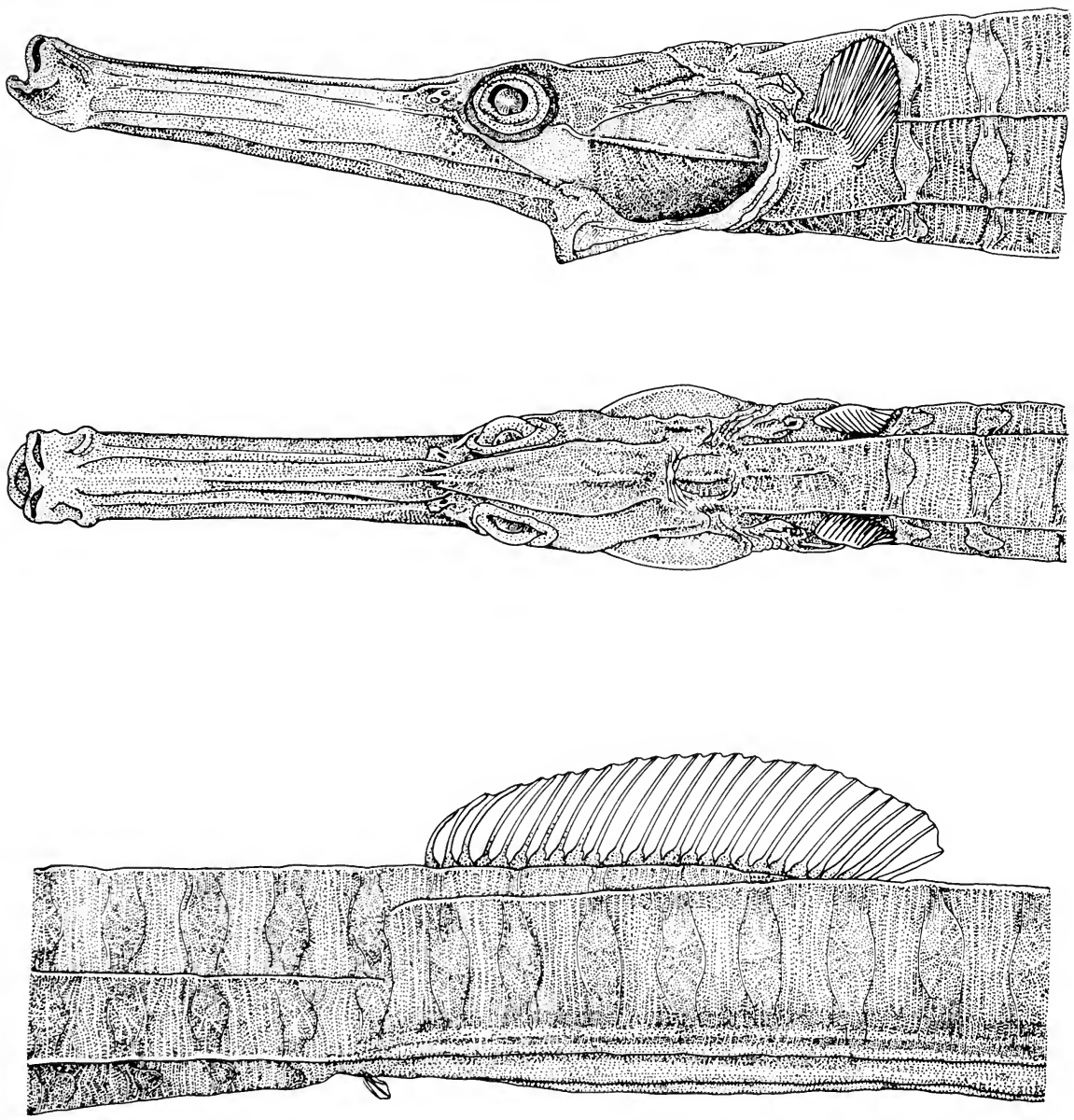


Figure 6. *Parasyngnathus penicillus*. Lateral and dorsal aspects of head and anterior trunk rings, together with lateral section of body illustrating configuration of principal ridges, fin positions, and anterior portion of brood pouch. From adult male, 132 mm SL (GCRL 15717).

Colouration: Light tan to brownish; usually with a dark lateral stripe on snout and a narrow pale stripe on opercular ridge, often with dark spots or shading on lower half of snout; dorsum plain, mottled or blotched, sometimes with indications of about 10 narrow pale bars separated by 3-5 ring darker interspaces; sides of trunk typically with 5-7 irregular rows of brownish ocelli; sides of tail plain or mottled, usually with a semicircular pale blotch adjacent to inferior ridge of most rings; dorsal-fin rays plain or shaded with brown; pectoral-fin rays usually edged with brown; caudal fin brownish with pale distal margin.

Comparisons: Characters in key and diagnosis distinguish *P. penicillus* from its only congener, *P. parvicarinatus*.

Geographic variation: West to east clinal variation in meristic values has been demonstrated for several Indo-Pacific pipefishes (Dawson, 1977, 1981c), and present data (Tables 9, 10) indicate similar variation in *P. penicillus*. Frequencies of tail rings and total rings are lowest in material from the Arabian Gulf and highest in samples from Japan and Queensland. Frequencies of dorsal- and pectoral-fin rays show less variation, but the Queensland population has slightly higher values than material from other areas.

Although agreeing with other populations in meristic values and colouration, specimens from Japan (Pl. 1) and China have a somewhat shorter snout. Compared with Australian material, representative of the typical long-snouted form, 43 Japanese fish ($\bar{x} = 107.6$ mm SL) have higher average HL in SL and snout length in HL ratios (respectively, 8.9 and 2.2 versus 6.7 and 1.8) and a lower average snout depth in snout length ratio (4.0 versus 5.7). In the apparent absence of other distinguishing features, I do not consider these differences sufficient for separate taxonomic treatment. If future studies show that subspecific status is warranted, Snyder's (1911) name, *quinquarius*, is available for the short-snouted population.

Remarks: Duncker (1915) referred *Syngnathus penicillus* Cantor 1849 to the synonymy of *S. argyrostictus* Kaup 1856, but there is no justifiable basis for this action and Cantor's name has priority. The holotype of *S. penicillus* (BMNH 1860.3.19.526), conspecific with the holotype of *S. argyrostictus*, is a dried male specimen (89.5 mm overall length) which lacks part of the tail and much of the right side of the body. There are 17 trunk rings, 33 tail rings remain, the right pectoral fin is missing and the left fin is damaged. There is a complete ridge on the opercle, dorsal fin originates near the middle of the 1st tail ring and there are at least 25 dorsal-fin rays. Snout length is about 1.7 in HL and snout depth is 6.4 in snout length. Cantor (1849) described the holotype as having 6 caudal-fin rays, but, as noted by Duncker (1915), the tail was evidently regenerated.

The brood pouch extends below the anterior 15-24 tail rings in 42 examined males (79-149 mm SL). One fish (107 mm SL) has about 100 pouch eggs deposited in a single layer of two rows through 15 of 17 pouch rings, whereas another (128.5 mm SL) has about 70 embryos in each of 8-9 transverse rows through 20 of 22 pouch-rings.

Distribution: Known from the western Arabian Gulf to Honshu I., Japan and Australia. Most collections are from the lower reaches of streams and rivers, from estuaries and from other shallow inshore habitats. Australian records are from the Dampier Archipelago and Broome, Western Australia, from the East Alligator River and the vicinity of Darwin, Northern Territory, and from Cape York, Queensland to the vicinity of Newcastle, New South Wales.

Material examined: Two hundred and five specimens, 48-172 mm SL, including holotype.

Holotype: BMNH 1860.3.19.526 (damaged male, 89.5 mm overall length), Sea of Pinang (Malay Peninsula), July 1845, Cantor.

Other material: Arabian Gulf, Kuwait: GCRL 16282 (1, 55.5), GCRL 19015 (1, 86.5), GCRL 19016 (1, 87.5). Saudi Arabia: USNM 164344 (1, 99.5). India, Gulf of Cutch: CAS 39748 (3, 71-79). Thailand, Andaman Sea, near Pakchan R.: CAS 39650 (1, 82.5). Gulf of Siam: CAS 39646 (2, 69.5-116), CAS 39647 (1, 132), GCRL 15717 (2, 102.5-132). Indonesia, Borneo: AMS I.19355-010 (4, 57-123.5). Java: RMNH 3849 (121, male, holotype of

Syngnathus argyrostictus). Philippine Is.: ANSP 48644 (1, 119.5), USNM 217520 (1, 53.5). China, Shanghai: FMNH 83876 (17, 111-159), GCRL 16749 (2, 145.5-148). Japan, Tanegashima I.: CAS-SU 22256 (16, 77-117.5), USNM 68227 (121, male, holotype of *Corythroichthys quinquarius*). Kyūshū I.: GCRL 17853 (6, 82-149.5), GCRL 17854 (7, 70-106.5), GCRL 17963 (31, 51.5-129), GCRL 18249 (5, 48-60), UMMZ 205280 (2, 83-94.5). Honshu I.: FMNH 83878 (1, 122), GCRL 17437 (1, 127.5), UMMZ 205277 (1, 137), YCM P.5985 (1, 109). Loc. uncertain: YCM P.5972 (1, 118), YCM P.5976 (1, 117), YCM P.5979 (2, 90-129), YCM P.5992 (1, 142), YCM P.5993 (2, 131-140), YCM P.5995 (1, 140), YCM P.5997 (1, 140). Papua New Guinea, Meiro R.: BPBM 13649 (1, 139). Varoi R.: KFRS F.4661.12 (1, 100). Australia, W.A.: WAM P.2871 (75.5, juvenile, holotype of *Hippichthys gazella*), WAM P.25118-013 (1, 114.5), WAM P.25668-011 (1, 76), WAM P.27488-001 (1, 143.5), WAM P.27490-001 (1, 59). N.T.: AMNH 35964 (2, 60.5-64), CSIRO uncat. (4, 55-92.5), GCRL 15541 (1, 62.5), NTM S.10020-009 (1, 77.5), NTM S.10414-001 (1, 53.5). Qld.: AMS I.385 (130, female, lectotype of *Syngnathus altirostris*), AMS I.22720-001 (3, 86.5-120.5), AMS I.22721-001 (1, 102), AMS I.22789 (29, 78-161.5), AMS I.22083-003 (1, 75.5), AMS IA.7982 (1, 143), GCRL 18542 (8, 97.5-147.5), NMV A.676 (1, 152.5), QM I.2932 (1, 100.5), QM I.4997 (1, 113), QM I.6591 (1, 88), QM I.7336 (1, 104), QM I.7988 (1, 139.5), QM I.8004 (1, 149.5), QM I.8045 (1, ca. 140), QM I.8208 (1, 119), QM I.10979 (2, 129-146), QM I.17855 (1, 133), QM I.18086 (1, 119.5), ROM 39318 (2, 102.5-140), WAM P.26981-006 (2, 70-108). N.S.W.: AMS B.7063 (damaged male, 143 mm overall, paralectotype of *S. altirostris*), AMS I.19231-001 (1, 92), AMS IA.4520 (1, 114), AMS IA.5098 (1, 172), AMS IA.5099 (1, 152), AMS IB.4211 (1, 129.5). Loc. uncertain: BMNH 1982.5.12.1 (125, female, holotype of *S. biserialis*, China or India, Hardwick col.).

Parasyngnathus parvicarinatus (Dawson)

Plate 2

Syngnathus parvicarinatus Dawson, 1978b: 288, Figs. 1-2 (orig. descr.; Darwin, N.T.).

Diagnosis: Trunk rings modally 15; snout length 3.0-3.3 in HL; scutella with keel-like ridges in subadults-adults.

Description: Rings 15 + 36-38, dorsal-fin rays 24-27, dorsal-fin origin between rear margins of last trunk ring and 1st tail ring, total subdorsal rings 5.0-6.0, pectoral-fin rays 14-17, see Tables 1-8 for additional counts. Proportional data, based on 11 specimens 53.5-78.5 ($\bar{x} = 63.4$) mm SL, follow: HL in SL 8.5-9.2 (8.9), snout length in HL 3.0-3.3 (3.1), snout depth in snout length 1.5-1.9 (1.7), length of dorsal-fin base in HL 1.2-1.4 (1.3), anal ring depth in HL 3.0-3.9 (3.4), trunk depth in HL 2.2-2.8 (2.6), pectoral-fin length in HL 5.7-6.7 (6.1). Scutella with prominent keel-like ridges in subadults-adults.

Colouration: Light tan to brown; head streaked or blotched with brown; dorsum and upper part of side of trunk plain or somewhat mottled; dorsum of tail sometimes shading to dark brown distally, sometimes with 2-3 diffuse pale bars; lower part of side and venter of trunk usually with a dark bar on anterior part of each ring; dorsal and pectoral fins hyaline; caudal fin brown with pale margin.

Comparisons: Characters in key and diagnosis distinguish this species from its only congener, *P. penicillus*.

Remarks: Males may have the brood pouch developed at 78.5 mm SL; probably fails to exceed 100-125 mm SL.

Distribution: Known only from the East Alligator River and from tidepools in Dinah Beach Inlet, Darwin, Northern Territory. This species is sympatric with *P. penicillus* in both localities.

Material examined: Fourteen specimens, 40.5-78.5 mm SL, including holotype and 11 paratypes.

Holotype: WAM P.25801-001 (78.5, male), Dinah Beach Inlet, Darwin, N.T., 18 May 1969, D. E. Rosen and party.

Paratypes: AMNH 35963 (6, 44.5-73), AMS I.20563-001, formerly AMNH 35963 (2, 55-57), GCRL 15644 (2, 70-73), and USNM 217594 (1, 65); all taken with holotype.

Other material: Australia, N.T.: CSIRO uncat. (2, 40.5-44.5).

Table 1. Frequency distributions of trunk rings in Australian species of *Parasyngnathus*, *Vanacampus*, *Pugnaso*, *Kaupus*, *Mitotichthys* and *Histiogamphelus*.

Genus	Trunk rings								
Species	15	16	17	18	19	20	21	22	23
Parasyngnathus									
penicillus	6	70	1						
parvicarinatus	14*								
Vanacampus									
vercoi		17*							
phillipi			20	124	41	6			
margaritifer				8	55	2			
poecilolaemus				2	29	15			
Pugnaso									
curtirostris			1	111*	7				
Kaupus									
costatus		13*	23	1					
Mitotichthys									
tuckeri							3	6	2*
semistriatus					3*	32			
meraculus						2*			
mollisoni[1]						1*			
Histiogamphelus									
briggsii						1	32	4*	
cristatus				1	4	4			

*Primary type.
[1] Data from orig. descr.

Vanacampus Whitley

Vanacampus Whitley, 1951a: 62 (as subgenus of *Parasyngnathus* Duncker; type-species by original designation: *Syngnathus vercoi* Waite and Hale, 1921).

Diagnosis: Median dorsal snout ridge low, not a high plate-like process extending above a horizontal through dorsal rim of orbit, usually terminating near middle of interorbital; opercle typically with a complete, straight, longitudinal ridge; supraopercular ridge present; dorsum of trunk and tail flat to somewhat depressed between superior ridges; principal body ridges distinct, sometimes a little elevated, superior trunk ridge not arched dorsad on subdorsal rings; with 1-2 ridges on pectoral-fin base; scutella without keel-like ridges; dorsal-fin origin on trunk or tail, fin-base not elevated; trunk rings 16-20, total rings 53-71; dorsal-fin rays 19-31; total subdorsal rings 4.25-8.0; pectoral-fin rays 8-14; anal-fin rays 3-4; trunk depth of adult females little greater than that of adult males; pouch plates absent or vestigial; pouch closure the semi type (Fig. 1).

Comparisons: The combination of a complete opercular ridge, 8-14 pectoral-fin rays, semi type of pouch closure, absence of elevated snout ridge and dorsal-fin base, and absence of well-developed pouch plates distinguishes *Vanacampus* from other genera treated here.

Remarks: Whitley (1951a) referred the type-species (*Syngnathus vercoi*) to the genus *Parasyngnathus* Duncker, and diagnosed *Vanacampus* solely on the basis of the short snout and lower number of dorsal-fin rays of *Syngnathus vercoi*. Such differences alone are

inadequate for subgeneric or generic distinction of any pipefish, but Whitley's name (*Vanacampus*) is available for the genus diagnosed here. Although *V. vercoi* has fewer trunk rings, dorsal-fin rays, total subdorsal rings, a shorter snout, and a more posterior dorsal-fin origin than congeners, I find no justification for affording separate status to this species.

This endemic Australian genus includes four marine-estuarine species.

KEY TO THE SPECIES OF *VANACAMPUS*

1a. Trunk rings 17-20, modally 18-19; total subdorsal rings 5.5-8.0; snout length 1.6-2.4 in HL 2
1b. Trunk rings 16; total subdorsal rings 4.25-5.0; snout length 2.6-2.8 in HL ..... *vercoi*
2a. Tail rings 38-51 (39 or more in 99.6%); subdorsal tail rings 4.5-6.75 (5.0 or more in 98%) 3
2b. Tail rings 34-38 (37 or fewer in 89%); subdorsal tail rings 3.5-5.25 (4.75 or fewer in 89%) ..... *margaritifer*
3a. Total rings 55-65 (63 or fewer in 98%); pectoral-fin rays 9-12 (modally 10); snout depth averages 5.5 in snout length; pectoral-fin length averages 6 in HL ..... *phillipi*
3b. Total rings 64-71 (65 or more in 94%); pectoral-fin rays 11-14 (modally 12); snout depth averages 8.4 in snout length; pectoral-fin length averages 8 in HL ..... *poecilolaemus*

Vanacampus vercoi (Waite and Hale)

Figure 7, Plate 2

Ichthyocampus filum (not of Günther) Zietz, 1908: 298 (misident., listed; Spencer Gulf, S.A.).

Syngnathus vercoi Waite and Hale, 1921: 293, 295, 298, Fig. 41 (in keys, orig. descr.; Spencer Gulf, S.A.); Whitley, 1951a: 62 (type-species of *Vanacampus*); Munro, 1958: 83, Fig. 574 (characters); Scott, 1962: 117, 118, Fig. (in key, comparisons); Scott et al., 1974: 132, Fig. (in key, comparisons); Glover, 1976: 171 (compiled); Glover, 1979: 150 (listed).

Corythoichthys vercoi. McCulloch, 1929: 87 (n. comb., compiled).

Corythroichthys vercoi. Scott, 1939: 141 (emendation, in key).

Parasyngnathus (*Vanacampus*) *vercoi*. Whitley, 1951a: 62 (n. comb., as type-species of *Vanacampus*); Whitley and Allan, 1958: 59 (listed); Whitley, 1964: 38 (listed).

Corythoichthys flindersi. Scott, 1957: 182, Fig. 2 (orig. descr.; Pelican Lagoon, Kangaroo I., S.A.); Scott, 1966: 93 (note on opercular ridge); Glover, 1976: 171 (compiled).

Syngnathus flindersi. Munro, 1958: 84, Fig. 582 (n. comb., characters); Scott, 1962: 117, Fig. (in key, characters); Scott, 1971: 123 (note on opercular ridge); Scott et al., 1974: 132, Fig. (in key, characters; Pelican Lagoon, Kangaroo I.); Glover, 1979: 139, 147, 150 (among vegetation, Kangaroo I.).

Parasyngnathus (*Vanacampus*) *flindersi*. Whitely and Allan, 1958: 59 (n. comb., listed); Whitley, 1964: 38 (listed).

Diagnosis: Trunk rings modally 16; total subdorsal rings 4.25-5.0; HL averages 10.0 in SL; snout length 2.6-2.8 in HL.

Description: Rings 16+40-42, dorsal-fin rays 19-21, dorsal-fin origin between posterior half of last trunk ring and posterior margin of 1st tail ring, usually at anterior margin of 1st tail ring; total subdorsal rings 4.25-5.0; pectoral-fin rays 8-9 (usually 9), see Tables 1-8 for additional counts. Proportional data, based on 9 specimens 66.5-101.5 ($\bar{x}$ = 84.1) mm SL, follow: HL in SL 9.6-10.6 (10.0), snout length in HL 2.6-2.8 (2.7), snout depth in snout length 2.8-3.2 (3.0), length of dorsal-fin base in HL 1.2-1.5 (1.4), anal ring depth in HL 2.4-3.3 (2.9), trunk depth in HL 2.0-2.7 (2.3), pectoral-fin length in HL 4.3-5.1 (4.7).

Colouration: Largely brownish; lower half of opercle often with pale spots or bars; venter of head mostly pale; dorsum of body plain or with 4-6 widely spaced, narrow (one ring), pale bars; sides of trunk usually with prominent brown bars on anterior half of each ring; venter of trunk often with a few pale spots or blotches on pectoral ring, elsewhere mainly plain; sides and venter of tail plain, spotted or mottled; dorsal-

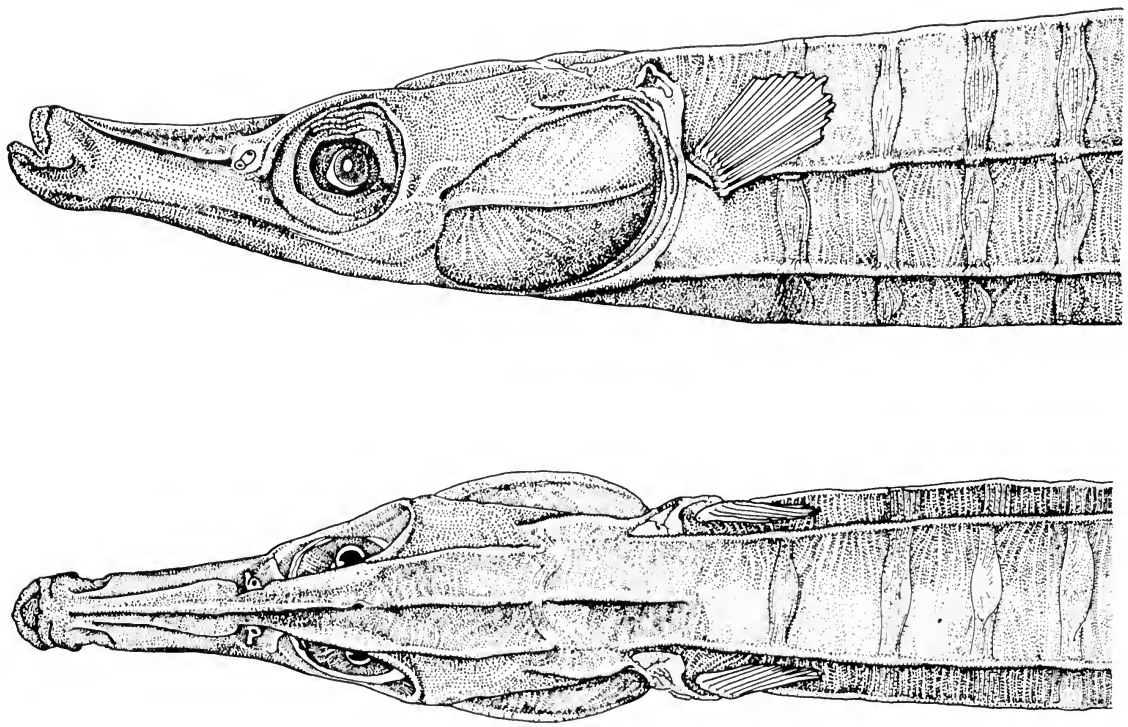


Figure 7. *Vanacampus vercoi*. Lateral and dorsal aspects of head and anterior trunk rings. From adult male, 101.5 mm SL (AMS I.20193-006).

fin rays edged with 3-5 pairs of fine brown lines; pectoral fin shaded with brown or with fine brown edging on fin-rays; caudal fin brown with pale margin.

Comparisons: Characters in key and diagnoses distinguish *V. vercoi* from congeners. Two other short-snouted pipefishes, *Kaupus costatus* and *Pugnaso curtirostris*, have been confused with this species, and all three may be expected in a single sample. *Vanacampus vercoi* has fewer dorsal-fin rays than *Kaupus costatus* (19-21 versus 30-36), and is readily distinguished from *Pugnaso curtirostris* by a lower modal trunk ring count (16 versus 18) and by the complete opercular ridge (absent in subadults-adults of *P. curtirostris*).

Remarks: Waite and Hale (1921) gave counts of 16+43 rings and 10 pectoral-fin rays for the holotype and noted that their material included "several other examples". I find the holotype (now 101.5 mm SL) to have 16+41 rings and 9 rays in each pectoral fin. Glover (1976) listed 18 paratypes in SAM F.691, but I find only 15 specimens, including one *Pugnaso curtirostris*, in this lot.

Scott (1957) described *Corythoichthys flindersi* from two female specimens (91 and 94 mm TL), gave counts of 15+40 rings, 21 dorsal-fin rays and 12 pectoral-fin rays, and noted the presence of "two distinct keels" on the operculum. The holotype (SAM F.2922), now lacking caudal fin and part of the tail, has 16 trunk rings, 21 dorsal-fin rays and 9 rays in each pectoral fin. The paratype (CAS 20750), now in very poor condition, has 16+42 rings, 21 dorsal-fin rays and 9 rays in each pectoral fin. Neither fish has two ridges on the operculum, and I find these specimens to be conspecific with *Vanacampus vercoi*.

The holotype of *V. vercoi* has the brood pouch extending below the anterior 14 tail rings. The pouch eggs are lost but the pouch retains ca. 20 membranous egg-compartments in two transverse rows through 12 pouch rings.

The pouch extends below 14-16 rings in two other examined males (88-101.5 mm SL). This pipefish probably fails to exceed 125 mm SL. Scott et al. (1974) described this species as very common, but there are few specimens in collections.

Distribution: Known only from Spencer Gulf, Gulf St. Vincent and Kangaroo I., South Australia. Available data indicate collections among "weed" and "seagrass" in depths of 2-3 m.

Material examined: Twenty-three specimens, 65-104 mm SL, including holotype and fourteen paratypes.

Holotype: SAM F.690 (101.5, adult male), Spencer Gulf, S.A., dredge, 7 Dec. 1920, J. Verco.

Paratypes: SAM F.691 (14, ca. 65-104), taken with holotype.

Other material: Australia, S.A.: AMS I.20193-006 (2, 72.5-101.5), CAS 20750 (1, 86, paratype of *Corythoichthys flindersi*), SAM F.2427 (2, 65-76.5), SAM F.2922 (damaged female, holotype of *C. flindersi*), SAM F.3584 (1, 91.5), SAM F.3918 (1, 66.5).

Vanacampus margaritifer (Peters)

Plate 3

Syngnathus margaritifer Peters, 1869: 457 [orig. descr.; Sydney (N.S.W.)]; Duméril, 1870: 550, 566 (in key, descr. compiled); Günther, 1870: 171 (characters, Port Jackson); Castelnau, 1875: 48 (colour note, Qld.); Castelnau, 1879: 356, 360 (listed, Australian endemic); Macleay, 1882: 289 (characters compiled); Tenison-Woods, 1882: 23 (listed); Waite, 1904: 18 (listed); Duncker, 1909: 245 (characters; N.S.W. and Bowen and Boston I., Qld.); Fowler, 1931: 323 (refs. only); Munro, 1958: 83, Fig. 576 (characters, range); Kähsbauer, 1978: 312 (characters; Boston I., Qld. (Godeffroy col.) to Sydney).

Corythroichthys margaritifer. McCulloch, 1911: 26 (n. comb., close to *C. phillipi*).

Syngnathus (*Parasyngnathus*) *margaritifer*. Duncker, 1915: 29, 83 (n. comb., descr., range).

Corythoichthys margaritifer. McCulloch, 1921: 36 (emendation, in key); McCulloch and Whitley, 1925: 137 (compiled); McCulloch, 1929: 87 (compiled).

Hippichthys margaritifer. Whitley, 1940: 414, Fig. 22 (n. comb.; Bowen, Qld.).

Parasyngnathus margaritifer. Whitley and Allan, 1958: 59 (n. comb.; Qld., N.S.W.); Whitley, 1964: 38 (listed).

Diagnosis: Trunk rings modally 19; tail rings 35-38; subdorsal tail rings 3.5-5.25 (usually 4.75 or fewer); HL averages 8.2 in SL; without a bar-like series of short pale stripes on side of anterior tail rings.

Description: Rings 18-20 + 34-38, dorsal-fin rays 22-26, subdorsal rings 2.75-1.0 + 3.5-5.25 = 5.5-6.75, pectoral-fin rays 10-12 (modally 11), see Tables 1-8 for additional counts. Proportional data, based on 30 specimens 84.0-152.0 ($\bar{x} = 136.9$) mm SL, follow: HL in SL 7.5-9.1 (8.2), snout length in HL 1.8-2.3 (1.9), snout depth in snout length 4.5-7.8 (5.8), length of dorsal-fin base in HL 1.2-1.6 (1.4), anal ring depth in HL 3.5-5.1 (4.1), trunk depth in HL 2.7-4.5 (3.5), pectoral-fin length in HL 5.1-7.9 (6.6).

Colouration: Tan to dark brown; opercle usually with an irregular pale stripe or blotch along longitudinal ridge, head elsewhere plain or irregularly blotched; dorsum of body usually with indications of 12-13 diffuse pale bars (ca. one ring wide) separated by 3-5 ring darker interspaces; side of trunk typically with a small pale ocellus or blotch on each scutellum and with a small pale spot or blotch near middle of lateral and inferior ridges of each ring; venter of trunk often plain, median ridge sometimes dark brown; side and venter of tail plain or irregularly flecked with pale. Dorsal fin hyaline, irregularly shaded with brown or with indications of short brownish bars on each fin-ray; pectoral-fin rays usually edged or shaded with brown; caudal fin brown with pale distal margin.

Comparisons: Among congeners, *V. margaritifer* is most similar to *V. phillipi*. Both these species overlap in meristic values, as well as in geographic range. In addition to

Table 2. Frequency distributions of tail rings in Australian species of *Parasyngnathus*, *Vanacampus*, *Pugnaso*, *Kaupus*, *Mitotichthys* and *Histiogamphelus*.

Genus / Species	Tail rings																							
	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Parasyngnathus																								
penicillus										2	18	35	20	2										
parvicarinatus									3	9	2*													
Vanacampus																								
vercoi													3	10*	4									
phillipi											1	9	19	25	33	46	41	15	2					
margaritifer							1	27	24	7	6													
poecilolaemus																	1	7	9	4	18	5	1	1
Pugnaso																								
curtirostris														11	19	54	35*							
Kaupus																								
costatus								6	8	14*	9													
Mitotichthys																								
tuckeri													1	7*	3									
semistriatus																			7	8	15*	3	2	
meraculus							1	1*																
mollisoni [1]																	1*							
Histiogamphelus																								
briggsii						4	17	9*	6	1														
cristatus	2	3	4																					

*Primary type.
[1] Data from orig. descr.

Table 3. Frequency distributions of total rings in Australian species of *Parasyngnathus*, *Vanacampus*, *Pugnaso*, *Kaupus*, *Mitotichthys* and *Histiogamphelus*.

Genus / Species	Total rings																								
	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
Parasyngnathus																									
penicillus							2	21	34	18	2														
parvicarinatus					3	9	2*																		
Vanacampus																									
vercoi										3	10*	4													
phillipi									1	2	6	14	24	35	43	42	20	3	1						
margaritifer							2	30	21	8	4														
poecilolaemus																		3	12	6	16	6	1	1	1
Pugnaso																									
curtirostris													10	19	53	35*	2								
Kaupus																									
costatus					2	8	6*	16	4	1															
Mitotichthys																									
tuckeri																2	6	3*							
semistriatus																			1	7	8*	14	3	2	
meraculus								1	1*																
mollisoni[1]																		1*							
Histiogamphelus																									
briggsii								2	17	10	7*	1													
cristatus	3	1	1	1	3																				

*Primary type.
[1] Data from orig. descr.

Table 4. Frequency distributions of dorsal-fin rays in Australian species of *Parasyngnathus, Vanacampus, Pugnaso, Kaupus, Mitotichthys* and *Histiogamphelus.*

Genus	Dorsal-fin rays																				
Species	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Parasyngnathus																						
penicillus							1	3	24	33	16		1									
parvicarinatus						1	3	5*	5													
Vanacampus																						
vercoi	1	6*	6																			
phillipi				6	23	48	52	45	13	1	1											
margaritifer				3	8	30	21	3														
poecilolaemus							1		12	14*	17	4	2									
Pugnaso																						
curtirostris			1	14	59*	34	8															
Kaupus																						
costatus												1	8	10	9	5	4	2				
Mitotichthys																						
tuckeri																	2	6*	2	1		
semistriatus																		2	5	13*	8	4
meraculus							1															
mollisoni [1]										1*												
Histiogamphelus																						
briggsii						5*	16	11	4	1												
cristatus					1	1	5	2														

*Primary type.
[1] Data from orig. descr.

Table 5. Frequency distributions of pectoral-fin rays in Australian species of *Parasyngnathus*, *Vanacampus*, *Pugnaso*, *Kaupus*, *Mitotichthys* and *Histiogamphelus*.

Genus	Pectoral-fin rays										
Species	8	9	10	11	12	13	14	15	16	17	18
Parasyngnathus											
penicillus								13	84	43	5
parvicarinatus							2	12*	8	4	
Vanacampus											
vercoi	2	29*									
phillipi		62	171	78	28						
margaritifer			5	88	29						
poecilolaemus				10*	70*	15	1				
Pugnaso											
curtirostris	7	148	51*	4							
Kaupus											
costatus		11	62*	1							
Mitotichthys											
tuckeri			1	14*	7						
semistriatus					19	43*	2*				
meraculus						2					
mollisoni [1]											1*
Histiogamphelus											
briggsii				2	27	40*	5				
cristatus				1	13	3					

*Primary type.
[1] Data from orig. descr.

characters in the key and diagnoses, most subadult-adult specimens of *V. margaritifer* differ from those of *V. phillipi* in the more or less regular arrangement of pale spots on the trunk rings (spots absent or irregular in *V. phillipi*). Furthermore, specimens of *V. margaritifer* tend to have a longer snout (snout length in HL averages 1.9 versus 2.1 in *V. phillipi*), a higher average snout depth in snout length ratio (5.8 versus 5.5 in *V. phillipi*), and brooding males tend to have more pouch eggs (maximum number ca. 100 versus <50 in examined *V. phillipi*).

Remarks: Peters (1869) based his original description on single male and female specimens from Sydney. His counts and measurements are evidently those of the male alone. This fish (ZMB 5035) was described as having 20+35 rings, 21 dorsal-fin rays and 9 caudal-fin rays, but I count 19+36 rings, 24 dorsal-fin rays and 10 rays in the damaged caudal fin. I have been unable to locate the female syntype.

The brood pouch extends below the anterior 13-18 tail rings in 23 males (91.5-152 mm SL), with the smallest examined brooding male measuring 129 mm SL. In two males (129 mm SL), pouch eggs are deposited in a single layer of four transverse rows with 25-26 eggs in each row and each row extends across 14 of 15 pouch rings. Young are ca. 10.1 mm SL when ready to leave the brood pouch.

Present specimens do not show significant geographic variation in colouration or meristic values.

Distribution: Based on material examined, *V.*

Table 6. Frequency distributions of subdorsal trunk rings in Australian species of *Vanacampus, Pugnaso, Kaupus, Mitotichthys* and *Histiogamphelus*. Dorsal fin located on tail in examined Australian specimens of *Parasyngnathus*.

Genus	Subdorsal trunk rings													
Species	10.25	9.50	8.75	8.00	7.25	6.50	5.75	5.00	4.25	3.50	2.75	2.00	1.25	0.50
Vanacampus														
vercoi														3
phillipi												8	124	69
margaritifer											9	41	16	
poecilolaemus												2	40*	8
Pugnaso														
curtirostris												3	66	58*
Kaupus														
costatus							12	24*	4					
Mitotichthys														
tuckeri	5*		5		1									
semistriatus									1	11	23*			
meraculus									1*	1				
mollisoni[1]											1*			
Histiogamphelus														
briggsii							4	18*	15					
cristatus							4	5						

*Primary type.
[1] Data from orig. descr.

margaritifer occurs from the vicinity of Southport, Queensland to Port Phillip Bay, Victoria and, provisionally, off Rottnest I., Western Australia. The latter record is based on two fish (21.5 and 126 mm SL) with 19+37 rings and 3.5-4.0 subdorsal tail rings collected from floating *Sargassum* sp. There are no specimens known from South Australia or Tasmania, and records from Bowen and Boston I. in northern Queensland (Duncker, 1909) cannot be confirmed here. This species occurs with it similar congener, *V. phillipi*, in southern New South Wales and Victoria.

Present data show that most collections are from estuarine or inshore areas in 0.5-10 m over sand, small rocks or rubble, and among "weed" or *Zostera* sp.

Material examined: Sixty-seven specimens, 21.5-152 mm SL, including one syntype.

Syntype: ZMB 5035, formerly Hamburg Mus. (130.5, adult male), Sydney, N.S.W.

Other material: Australia, Qld.: AMS I.22528-001 (1, 59.5). N.S.W.: AMS I.16502-002 (2, 97-110), AMS I.16799-011 (3, 104.5-142), AMS I.17895-003 (2, 127-129), AMS I.19126-001 (2, 129.5-132.5), AMS I.19360-002 (1, 132.5), AMS I.19901-003 (2, 133.5-144), AMS IB.2589 (2, 139.5-152), GCRL 16337 (1, 131), GCRL 16454 (7, 129-147), GCRL 16975 (1, 131), GCRL 17497 (1, 109.5), GCRL 19039 (2, 119-124.5), GCRL 19040 (6, 91.5-133), GCRL 19041 (7, 88.5-146.5), GCRL 19149 (1, 72), GCRL 19150 (11, 104-136), USNM 148617 (1, 97), USNM 215318 (1, 129). Vic.: AMS I.19777-007 (1, 85.5), AMS uncat. (1, 109.5), GCRL 16450 (4, 94-139.5), NMV A.660 (1, 125), NMV A.663 (1, 120), NMV A.693 (1, 70), NMV A.695 (1, 91.5). W.A.: GCRL 16458 (1, 126), GCRL 16462 (1, 21.5).

Vanacampus phillipi (Lucas)
Plate 3

Table 7. Frequency distributions of subdorsal tail rings in Australian species of *Parasyngnathus*, *Vanacampus*, *Pugnaso*, *Kaupus*, *Mitotichthys* and *Histiogamphelus*.

Genus / Species	Subdorsal tail rings								
	1.25	2.00	2.75	3.50	4.25	5.00	5.75	6.50	7.25
Parasyngnathus									
penicillus						4	64	12	
parvicarinatus						4	10*		
Vanacampus									
vercoi					10	10*			
phillipi					2	73	102	30	
margaritifer				13	41	12			
poecilolaemus						2	34*	14	
Pugnaso									
curtirostris				15*	97	15			
Kaupus									
costatus			13	23*	4				
Mitotichthys									
tuckeri	1	5*	4	1					
semistriatus								15*	20
meraculus				2*					
mollisoni[1]									1*
Histiogamphelus									
briggsii		2*	26	9					
cristatus	3	6							

*Primary type.
[1] Data from orig. descr.

?*Sygnathus* (sic) sp. Becker, 1857: 14, Figs. 1-3 (descr., notes on pouch larvae; Hobson's Bay, Vic.).

Syngnathus phillipi Lucas, 1891: 8, 12 (orig. descr.; Port Phillip Heads, Vic.); Duncker, 1909: 245 (characters, Albany, W.A. and Spencer's Gulf, S.A.); Waite and Hale, 1921: 295, 297, Fig. 40 (in key, synon., descr., range); Munro, 1958: 83, Fig. 575 (characters, range); Scott, 1961: 58 (characters in key); Scott, 1962: 117, Fig. (characters, quite common in shallow weedy areas, range); Scott, 1963: 17, Fig. 5 (synon., descr.; off Verona, Tas.); Scott, 1964: 85 (with *S. curtirostris*); Scott, 1968: 4, 6 (with *S. poecilolaemus*, *S. curtirostris* and *Lissocampus caudalis*; Kelso, Tas.); Scott, 1971: 123 (note on breeding season); Lenanton, 1974: 8, 14 (listed); Scott et al., 1974: 132, 134, Fig. (characters, range); Shiino, 1976: 110 (compiled); Scott, 1977: 124, 128 (descr., notes on brooding males, breeding season, depth of capture, etc.); Dawson, 1978b: 292 (name only); Glover, 1979: 150 (listed); Scott, 1979: 117 (synon., on estuarine shores, food item of unidentified platycephalid); Scott, 1980: 106 (listed); Last et al., 1983: 298, 311, Fig. 27.23 (in key, descr., range).

Corythroichthys phillipi. McCulloch, 1911: 26, Fig. 10 (n. comb., counts, compared with *C. margaritifer*; Oyster Bay, Tas.); Scott, 1939: 141 (characters in key).

Syngnathus (*Parasyngnathus*) *phillipi*. Duncker 1915: 39, 82 (n. comb., descr., range).

Corythoichthys phillipi. Lord, 1923: 64 (emendation, listed); Lord and Scott, 1924: 39

Table 8. Frequency distributions of total subdorsal rings in Australian species of *Parasyngnathus*, *Vanacampus*, *Pugnaso*, *Kaupus*, *Mitotichthys* and *Histiogamphelus*.

Genus	Total subdorsal rings											
Species	4.25	5.00	5.75	6.50	7.25	8.00	8.75	9.50	10.25	11.00	11.75	12.50
Parasyngnathus												
penicillus		4	64	12								
parvicarinatus		4	10*									
Vanacampus												
vercoi	7	13*										
phillipi			38	114	53	2						
margaritifer			30	36								
poecilolaemus				15*	32	3						
Pugnaso												
curtirostris	6*	97	24									
Kaupus												
costatus						13	26*	1				
Mitotichthys												
tuckeri									2	3	3*	3
semistriatus								13*	21	1		
meraculus					2*							
mollisoni[1]								1*				
Histiogamphelus												
briggsii				1*	18	18						
cristatus				2	7							

*Primary type.
[1] Data from orig. descr.

(characters, Tas.); Lord, 1927: 13 (listed); McCulloch, 1929: 87 (compiled); Scott, 1939: 139, 143 (distr. note); Whitley, 1948b:14 (compiled).

Parasyngnathus phillipi. Whitley and Allan, 1958: 59 (n. comb., range); Whitley, 1964: 37 (listed).

Syngnathus philippi (sic). Kähsbauer, 1978: 313 (characters).

Diagnosis: Trunk rings modally 18; tail rings 38-46; subdorsal tail rings 4.5-6.75 (usually 5.0 or more); HL averages 8.1 in SL; usually with a bar-like series of short pale lines or stripes on side of anterior tail rings.

Description: Rings 17-20+38-46, dorsal-fin rays 22-29, subdorsal rings 2.0-0.0+4.5-6.75=5.75-8.0, pectoral-fin rays 9-12 (modally 10-11), see Tables 1-8 for additional counts. Proportional data, based on 96 specimens 56.5-135.0 ($\bar{x}=101.6$) mm SL, follow: HL in SL 7.0-9.2 (8.1), snout length in HL 1.8-2.4 (2.1), snout depth in snout length 3.0-7.1 (5.5), length of dorsal-fin base in HL 1.1-1.6 (1.4), anal ring depth in HL 2.9-5.7 (3.9), trunk depth in HL 2.1-3.9 (2.9), pectoral-fin length in HL 4.8-8.6 (5.9).

Colouration: Upper half of head brownish or irregularly spotted, blotched or streaked with pale; lower half of opercle and venter of head usually pale in males, usually with irregular dark spots or streaks in females. Dorsum of body plain, mottled or streaked, sometimes with indications of 12-14 narrow pale bars. Side of trunk usually with dark-margined pale bars or blotches on upper and lower scutella of some or all rings, most often reduced to small spots posteriad, sometimes with longitudinal pale

Table 9. Geographic variation in frequencies of trunk, tail and total rings in *Parasyngnathus penicillus*.

	Trunk rings			Tail rings							Total rings							
Locale	15	16	17	35	36	37	38	39	40	41	50	51	52	53	54	55	56	57
Kuwait	4				1	2	1					1	2	1				
Saudi Arabia	1			1							1							
India		3			3								3					
Thailand		4	1			1	4							1	3	1		
Indonesia	1	4			2	2	1						2	3				
Philippine Is.		2						2								2		
China		18	1			1	4	13	1						5	13	1	
Japan		70					10	38	21	1					10	38	21	1
New Guinea	1	1						2							1	1		
Australia																		
W.A.		5				1	2	2						1	2	2		
N.T.	1	7				1	5	1	1					1	5	2		
Qld.	5	54					11	27	19	2					14	26	17	2
N.S.W.		4	1					5								4	1	

Table 10. Geographic variation in frequencies of dorsal- and pectoral-fin rays in *Parasyngnathus penicillus*.

	Dorsal-fin rays									Pectoral-fin rays				
Locale	23	24	25	26	27	28	29	30	31	14	15	16	17	18
Kuwait				1	2	1					5	2	1	
Saudi Arabia	1									1	1			
India						1	1			1	1	2		
Thailand			1	4	1						1	7	4	
Indonesia			1	3	1						1	4	1	
Philippine Is.			1									2		
China				1	6	7	2	2		3	23	6		
Japan			2	7	40	24	3			8	58	63	11	
New Guinea					1	1							4	
Australia														
W.A.				1	2	2						8	2	
N.T.				2	3		2					6	6	
Qld.			1		18	29	11		1		10	63	35	5
N.S.W.					1	2	3				3	7		

lines or streaks above the lateral ridge. Side of tail often with pale bars on anterior rings, usually with several narrow pale lines on each ring of anterior half or more of tail. Venter of trunk sometimes plain, often with irregular brown spots on anterior 3-4 rings, median ridge frequently brown; venter of tail plain, blotched or irregularly barred. Usually with 3-4 short brown bars on dorsal-fin rays, pectoral-fin rays shaded or edged with brown, caudal fin brown with pale margin.

Comparisons: This species is distinguished from congeners by characters in key and diagnosis. For further comparisons, see this section under *V. margaritifer*.

Remarks: Lucas (1891, p. 8) implied that "large numbers" of specimens were available for study and included measurements of two males and two females (99-121 mm TL) in the original description (p. 13). I have been unable to locate any of this material and it appears that the syntypes of *Syngnathus phillipi* are either lost or destroyed. Nevertheless, Lucas' counts of 18 + 40-44 rings, 25-26 dorsal-fin rays, 6 subdorsal tail rings and description of "whitish vertical bands" (e.g. pale bars) on the side, leave little doubt that his specimens were conspecific with material described here.

Among examined material, the brood pouch extends below 14-20 tail rings in 54 males (90.5-137 mm SL), pouch eggs are deposited in a single layer of two transverse rows in 14 brooding fish (93.5-137 mm SL), and total numbers of eggs range from 10 to 44.

Present data (Table 11) indicate some irregular geographic variation in frequencies of rings and dorsal- and pectoral-fin rays. Trunk rings are usually 18 in fish from New South Wales and Victoria but more variable (usually 18-19) in samples from South Australia and Tasmania, and numbers of tail rings are somewhat fewer in South Australian fish (38-43 versus 40-46 in other samples). Dorsal-fin rays are 24-27 in specimens from New South Wales, 22-26 in those from Victoria and South Australia, and 23-29 in Tasmanian material. Pectoral-fin rays are modally 10 in fish from New South Wales, Victoria and Tasmania, but 11 in samples from South Australia. These inconsistent variations apparently represent local population differences rather than clinal variation.

Distribution: This species is known from southern New South Wales (Moruya Point) to Kangaroo I. and Spencer Gulf, South Australia, from Tasmania (south to Port Arthur), and from off Albany and Cottesloe, Western Australia. Collections are recorded from estuarine and coastal waters to depths of ca. 24 m over sand and "small rocks" and among "weed" and *Zostera* sp.

Material examined: Two hundred and twenty-three specimens, 50-184 mm SL. Australia, N.S.W.: GCRL 15504 (5, 100-124), GCRL 16336 (1, 105.5), GCRL 16366 (3, 82.5-117.5), GCRL 16342 (3, 98-103.5), GCRL 16343 (3, 78.5-121.5), GCRL 16344 (12, 70-123), GCRL 16345 (4, 51-81.5), GCRL 16346 (13, 56-110), GCRL 16347 (15, 61.5-122). Vic.: GCRL 16449 (9, 96-135), GCRL 16864 (1, 116), GCRL 17365 (4, 108.5-126.5), GCRL 17373 (3, 103.5-130.5), GCRL 17950 (1, 95.5), NMV A.554 (8, 73-92), NMV A.556 (1, 111), NMV A.658 (2, 108-117), NMV A.659 (1, ca. 115), NMV A.661 (2, 100-128), NMV A.669 (1, 108), NMV A.670 (3, 85.5-98), NMV A.678 (1, 107.5), NMV A.679 (2, ca. 95), NMV A.682 (1, 63), NMV A.688 (1, 88.5), NMV A.691 (1, 86), NMV A.692 (1, 82), NMV A.1989 (3, 121-123.5), USNM 217819 (3, 93-99.5). S.A.: AMS I.20160-030 (1, ca. 95.5), AMS I.20179-019 (1, 56.5), AMS I.20193-007 (3, 82-105), GCRL 14818 (2, 99.5-102.5), MCZ 52102 (2, 99-110.5), NMV A.667 (1, 137), SAM F.688 (2, 96.5-125), SAM F.1867 (1, 110.5), SAM F.1873 (1, 144), SAM F.2403 (26, 64-113.5), SAM F.2428 (1, 72), SAM F.2480 (1, 103), SAM F.3662 (1, 96.5), SAM F.3886 (66-111), SAM F.4155 (2, 71-75), USNM 216256 (1, 108). Tas.: AMS I.20749-002 (2, 108), AMS I.22529-002 (1, 85), GCRL 14796 (19, 68.5-124.5), GCRL 17036 (3, 91.5-101.5), QM I.16659 (1, 137), QVM 1972/5/180 (2, 116.5-119), WAM P.27550-001 (1, 184). W.A.: WAM P.6276 (1, 109.5), WAM P.26474-001 (1, 115).

Vanacampus poecilolaemus (Peters)

Plate 4

Table 11. Geographic variation in frequencies of trunk rings, tail rings, and dorsal- and pectoral-fin rays in *Vanacampus phillipi*.

Locale	Trunk rings				Tail rings								
	17	18	19	20	38	39	40	41	42	43	44	45	46
N.S.W.	10	47	2					2	7	21	23	5	1
Vic.	4	26	7					1	6	13	13	4	
S.A.	6	32	22	5	1	9	18	21	10	6			
Tas.		18	10				1		9	6	5	6	1
W.A.		1		1				1	1				

	Dorsal-fin rays								Pectoral-fin rays			
	22	23	24	25	26	27	28	29	9	10	11	12
N.S.W.			9	23	18	9			26	77	8	
Vic.	1	4	10	12	9				21	47	8	
S.A.	5	17	21	11	10					17	56	23
Tas.		2	8	4	8	4	1	1	15	30	5	2
W.A.				2							1	1

Syngnathus poecilolaemus Peters, 1869: 458 (orig. descr.; Adelaide, S.A.); Duméril, 1870: 550, 552 (in key, descr. compiled); Günther, 1870: 174 (descr. compiled); Castelnau, 1872a: 243 (listed); Macleay, 1882: 290 (descr. compiled); Zietz, 1908: 298 (Gulf St. Vincent and Spencer Gulf, S.A.); Waite and Hale, 1921: 295, Fig. 39 (synon., descr., S.A. and W.A.); Kähsbauer, 1950: 266 (characters); Munro, 1958: 83, Fig. 573 (characters, range); Scott, 1962: 117, 119, Fig. (in key, descr., moderately common); Scott, 1968: 4, 6 (descr.; Kelso, Tas.); Scott, 1970: 35 (ref.); Scott et al., 1974: 132, 134, Fig. (in key, descr., to 280 mm (TL), range); Scott, 1977: 135 (proportions, counts, Bass Strait); Dawson, 1978b: 292 (notes on synon.); Glover, 1979: 150 (listed); Scott, 1980: 106 (listed); Last et al., 1983: 298, 312, Fig. 27.24 (in key, descr., range).

Syngnathus paecilolaemus (sic). Castelnau, 1873: 78 (colour note).

Syngnathus modestus (not of Günther, 1870) Sauvage, 1879: 209 (orig. descr.; Noble I., Aust.); Duncker, 1909: 246 (possibly = *S. poekilolaemus*); McCulloch and Whitley, 1925: 137 (= *Corythoichthys poecilolaemus*); Whitley, 1929: 118 (preoccupied); Bertin and Estéve, 1950: 47 (holotype listed); Dawson, 1978b: 291 (descr. of holotype).

Syngnathus poekilolaemus (sic). Duncker, 1909: 245 (characters; Barrow I., W.A.(?) and S.A.); Dawson, 1978b: 292 (name only).

Corythroichthys poecilolaemus. McCulloch, 1912: 82, Fig. 2 (n. comb.; descr.; Fremantle, W.A.); Scott, 1939: 141 (characters in key).

Syngnathus (*Parasyngnathus*) *poecilolaemus*. Duncker, 1915: 29, 82 (n. comb., descr., range).

Syngnathus (*Parasyngnathus*) *modestus*. Duncker, 1915: 28, 86 (n. comb., doubtful species, possibly = *S. poecilolaemus* or *S. phillipi*).

Corythoichthys poecilolaemus. McCulloch and Whitley, 1925: 137 (emendation, listed); Whitley, 1929: 118 (note); McCulloch, 1929: 87 (compiled); Dawson, 1978b: 292 (name only).

Corythoichthys sauvagei Whitley, 1929: 117 (replacement name for *Syngnathus modestus* Sauvage, preoccupied); McCulloch, 1929: 86 (compiled).

Parasyngnathus poecilolaemus. Whitley, 1948b: 14 (n. comb., listed); Whitley and Allan, 1958: 59, Fig. 16(1), (range); Whitley, 1964: 38 (listed).

Syngnathus sauvagei. Munro, 1958: 84 (n. comb., characters, Qld.); Dawson, 1978b: 291 (= *S. poecilolaemus*).

Parasyngnathus sauvagei. Whitley and Allan, 1958: 59 (n. comb., Qld.); Whitley, 1964: 37 (listed).

Syngnathus peocilolaemus (sic). Kähsbauer, 1978: 313 (data from holotype, range).

Vanacampus poecilolaemus. Glover, 1983: 163 (n. comb., listed).

Diagnosis: Trunk rings modally 19; tail rings 44-51; subdorsal tail rings 5.0-6.75 (usually 5.5 or more); HL averages 7.3 in SL.

Description: Rings 18-20 + 44-51, dorsal-fin rays 25-31, subdorsal rings 1.75-0.5 + 5.0-6.75 = 6.25-8.0, pectoral-fin rays 11-14 (modally 12), see Tables 1-8 for additional counts. Proportional data, based on 31 specimens 54.0-261.0 ($\bar{x}$ = 173.3) mm SL, follow: HL in SL 6.4-8.3 (7.3), snout length in HL 1.6-2.2 (1.8), snout depth in snout length 5.1-10.2 (8.4), length of dorsal-fin base in HL 1.3-1.8 (1.5), anal ring depth in HL 3.8-5.8 (4.7), trunk depth in HL 3.1-5.5 (3.8), pectoral-fin length in HL 7.0-9.5 (8.0).

Colouration: Dorsum and side of snout brownish with indistinct diagonal pale bars or blotches in adult males, venter of snout brownish, and venter of remainder of head and pectoral ring plain tan or pale. In adult females, snout barred or spotted with dark brown, with dark brown spots below eye, on lower half of opercle and on venter of pectoral ring. Dorsum of body largely brownish in both sexes; 6-9 irregular rows of small, dark-margined, ocelli on side of trunk; median ventral trunk ridge sometimes dark brown, elsewhere plain tan or brownish behind pectoral ring; lower part of subdorsal tail rings often with bar-like dark blotches on scutella, side of tail elsewhere mainly plain; venter of tail plain or with irregular dark streaks. Dorsal-fin rays often with indications of 3-4 short dark bars, pectoral-fin rays edged or shaded with brown, and caudal fin brownish with pale margin.

Comparisons: This pipefish reaches a greater length than congeners (ca. 270 versus 184 mm SL), and is otherwise distinguishable by characters in the key and diagnosis.

Remarks: Peters' (1869) description, based on a single female specimen (157 mm TL), includes counts of 20 + 49 rings, 11 pectoral-fin rays, 3 anal-fin rays, and 1 + 6 subdorsal rings. The holotype (ZMB 5316) now lacks part of the tail and I count 19 trunk rings, 12 rays in the right pectoral fin and 11 in the left, 3 anal-fin rays, and 1 + 5.75 subdorsal rings. Rows of ocelli persist on the side of the trunk, scutella are brown on the anterior part of the tail, and there are brown spots under the eye and on the side of the snout.

The brood pouch extends below 17-21 tail rings in 15 males (170-230 mm SL), 5 brooding fish have pouch eggs deposited in a single layer of 2-4 transverse rows, and total numbers of eggs are 48 and 42 in two males (188.5 and 230 mm SL).

Present material shows no evidence of significant geographic variation.

Distribution: Known from Gulf St. Vincent, Spencer Gulf and Kangaroo I., South Australia, from Tasmania, and from Geographe Bay to Carnac I. (32°07′S), Western Australia. Locality records of Duncker (1909) from Barrow I., Western Australia (20°46′S), and of Sauvage (1879) from Noble I., Queensland (14°30′S) are questionable. This pipefish has been recorded from estuaries and shallow "weedy" bays (Scott, 1962), and from *Zostera* sp. (Scott, 1968). Present data include collections by trawl, seine and SCUBA in 1-11 m.

Material examined: Fifty-two specimens, 45.5-261 mm SL, including holotype.

Holotype: ZMB 5316 (damaged female, 149.5 mm overall length), Adelaide, S.A.

Other material: Australia, S.A.: AMS I.20179-017 (1, 107), AMS I.20189-023 (1,

180.5), GCRL 14816 (2, 188.5-233), NMV A.699 (3, 198.5-227), SAM F.687 (19, 143-261), SAM F.1763 (1, 259.5), SAM F.2490 (2, 117.5-249), SAM F.2617 (1, 211), SAM F.3587 (1, 77.5), SAM F.3633 (2, 54-94.5), SAM F.4677 (1, 175), SAM uncat. (2, ca. 114.5). Tas.: QVM 1972/5/743 (1, 181.5), TFDA uncat. (1, 176). W.A.: GCRL 16267 (7, 45.5-213.5), WAM P.5886 (1, 186), WAM P.21010 (1, 235), WAM P.26467-001 (1, 189), WAM uncat. (2, 109.5-125). Loc. questionable or uncertain: MNHN A.983 (94.5, holotype of *Syngnathus modestus*), Noble I., Australia, Castelnau col.

Pugnaso Whitley

Pugnaso Whitley, 1948c: 75 (type-species by original designation: *Syngnathus curtirostris* Castelnau, 1872).

Diagnosis: Median dorsal snout ridge low, not a high plate-like process extending above a horizontal through dorsal rim of orbit, usually terminating on anterior third of interorbital; supraopercular ridge absent; opercular ridge usually complete and angled posterodorsad toward gill opening in early juveniles, vestigial or absent in subadults-adults; other head ridges vestigial or absent; pectoral-fin base without distinct ridges; dorsum of trunk and tail flat to a little convex; principal body ridges low, often indistinct, superior trunk ridge not arched dorsad on subdorsal rings; scutella indistinct, without keel-like ridges; dorsal-fin origin on trunk, fin-base not elevated; trunk rings 17-19; total rings 59-63; dorsal-fin rays 21-25; total subdorsal rings 4.5-5.75; pectoral-fin rays 8-11; anal-fin rays 2-3; trunk depth of adult females little greater than that of adult males; pouch plates absent; pouch closure the semi type (Fig. 1).

Comparisons: The combination of semi pouch closure, absence of pouch plates, poorly defined body ridges, absence of supraopercular ridge and ridges on pectoral-fin base, together with absence of opercular ridge (in subadults-adults) as well as the absence of elevated snout ridge and dorsal-fin base distinguishes *Pugnaso* from other genera treated here.

Remarks: *Pugnaso* is closely related to *Vanacampus* which shares the semi pouch closure and absence of well-developed pouch plates. However, young of *Pugnaso* have an arcuate opercular ridge, rather than the essentially straight ridge found in *Vanacampus*, and there are other seemingly significant differences in the development of head and body ridges. Pending further study, I treat *Pugnaso* as a monotypic endemic Australian genus.

Pugnaso curtirostris (Castelnau)

Figure 8, Plate 4

Syngnathus curtirostris Castelnau, 1872a: 243 (orig. descr.; St. Vincent's Gulf, S.A.); Macleay, 1882: 290 (descr.); Johnston, 1890: 37 (listed, Tas.); Zietz, 1908: 298 (dredged, Spencer Gulf); Duncker, 1909: 244 (characters); McCulloch and Waite, 1918: 39, pl. 5, fig. 1 (descr., fig. caption (p. 77) as "*curvirostris*"; Kangaroo I., S.A.); Waite and Hale, 1921: 293, 300, fig. 42 (descr.; St. Vincent's Gulf, Glenelg R., and Kangaroo I., S.A.); McCulloch, 1929: 86 (compiled); Mack, 1934: 179 (Hobson's Bay, Vic.); Scott, 1939: 141 (characters in key); Scott, 1942: 19 (characters in key, not known from Tas.); Whitley, 1948c: 75 (type-species of *Pugnaso*); Bertin and Estéve, 1950: 47 (presumptive holotype listed as "paratype"); Scott, 1953: 150 (descr.; Low Head, Tas.); Scott, 1955: 135 (characters in key); Munro, 1958: 82, fig. 569 (characters, Vic. and S.A.); Scott, 1961: 59, 62 (characters in key, synon., notes on Tas. records); Scott, 1962: 117, fig. (in key, characters, range); Scott, 1964: 85 (proportional data, colour description, Tas.); Scott, 1966: 93 (descriptive data); Scott, 1968: 4, 6 (taken with *S. poecilolaemus, S. phillipi* and *Lissocampus caudalis*); Scott, 1970: 35 (ref.); Scott, 1971: 123 (note on breeding); Scott et al., 1974: 132, fig. (characters, range); Scott, 1977: 123 (compared with *S. caretta*, Tas.); Dawson, 1978b: 292 (data from holotype, compared with *S. caretta*); Glover, 1979: 150 (listed); Hutchins, 1979: 93 (listed); Scott, 1980: 106 (listed); Last et al., 1983: 298, 310, Fig. 27.21 (in key, descr., range).

Syngnathus modestus (not of Günther, 1870) Klunzinger, 1872: 44 (Port Philip, S.A.); Klunzinger, 1879: 419 (= *S. caretta*).

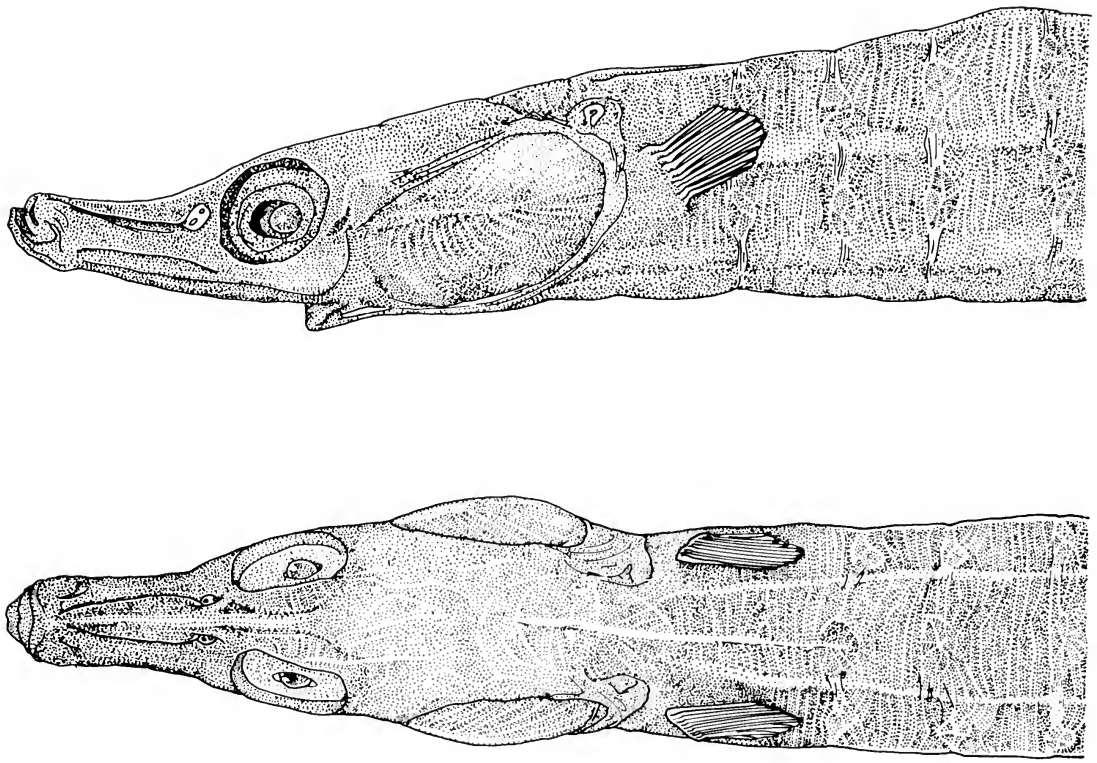


Figure 8. *Pugnaso curtirostris*. Lateral and dorsal aspects of head and anterior trunk rings. From adult female, 179 mm SL (GCRL 16266).

Synghathus (sic) *curtirostris*. Castelnau, 1873: 79 (descr.).

Syngnathus caretta Klunzinger, 1879: 419 [orig. descr.; Port Philip (S.A.)]; Macleay, 1884: 60 (descr. compiled); Lucas, 1890: 38 (compiled); Duncker, 1909: 244 (characters, possibly = *S. curtirostris*); Scott, 1977: 122 (synon., generic status, descr., comparisons; among *Zostera*; N. coast, Tas.); Dawson, 1978b: 291, fig. 1 (descr. of holotype, = *S. curtirostris*); Scott, 1980: 106 (listed).

Leptonotus caretta. McCulloch, 1928: 85 (n. comb., compiled); Scott, 1939: 141 (characters in key); Whitley, 1941: 16, fig. 12 (characters); Munro, 1958: 85, fig. 587 (characters, Vic.); Dawson, 1978b: 291 (name only).

Pugnaso curtirostris. Whitley, 1948c: 75 (n. comb.); Whitley and Allan, 1958: 59 (range); Whitley, 1964: 37 (listed); Glover, 1983: 163 (listed).

Pugnaso caretta. Whitley and Allan, 1958: 59 (n. comb., Vic.); Whitley, 1964: 37 (listed); Dawson, 1978b: 292 (name only).

?*Syngnathus philippi* (sic). Kähsbauer, 1976: 286 (probable misident., Vic.).

Diagnosis: See that of genus.

Description: Rings 17-19 + 41-44, dorsal-fin rays 21-25, subdorsal rings 1.75-0.25 + 3.25-5.0 = 4.5-5.75, pectoral-fin rays 8-11 (modally 9), see Tables 1-8 for additional counts. Proportional data, based on 48 specimens 53.5-170.0 ($\bar{x}$ = 120.0) mm SL, follow: HL in SL 9.1-12.2 (11.1), snout length in HL 2.5-3.0 (2.7), snout depth in snout length 1.7-3.4 (2.9), length of dorsal-fin base in HL 1.1-1.6 (1.3), anal ring depth in HL 2.4-4.5 (3.1), trunk depth in HL 2.0-3.8 (2.7), pectoral-fin length in HL 4.2-6.5 (5.1).

Colouration: Colouration highly variable.

Some fish with a pale snout and a few irregular pale markings elsewhere on the head, a tan or light brown dorsum with 12-14 narrow bars between head and caudal fin, and with the body elsewhere largely dark brown. Others variegated throughout with tan, brown and pale. Most fish with spots or blotches on the head; dorsum of body, upper half of side of trunk and side of tail largely brown; lower half of side of trunk with more or less quadrate brown blotches on each ring, with a few pale spots on lateral ridge above and a dark-margined pale bar below which may continue on venter; venter of trunk usually pale or tan, plain or with short dark-margined pale bars on each ring near inferior ridges; venter of tail brownish, with or without irregular markings. Dorsal-fin rays with 3-4 short brown bars, membrane sometimes shaded with brown; caudal fin brown with pale distal margin.

Remarks: Castelnau (1872a) briefly diagnosed this species as having a dark brown colour with silvery spots on the head and anterior part of the body, and as having snout length 3 in HL. His later description (1873), based on a single specimen "a little over four inches and a half" long, included counts of 18+42 rings, 20 dorsal-fin rays, 0+5 subdorsal rings, and 6 caudal-fin rays. The presumptive holotype (MNHN A.982) has 44 tail rings, 23 dorsal-fin rays, 0.75+3.75 subdorsal rings, 10 rays in each pectoral fin and 10 caudal-fin rays. This female or immature male fish (now 116.5 mm SL) approximates the described length of the holotype. Its snout length is 2.7 in HL. Despite discrepancies in some meristic values, the specimen is conspecific with material described here, and there appears to be little doubt that it formed the basis for Castelnau's description.

The opercular ridge is often complete in specimens <50 mm SL, usually faint and incomplete at lengths of 50-100 mm SL, and is typically absent in larger fish.

The brood pouch extends below 9-18 (usually 15-17) tail rings in 25 males (119-182 mm SL) and the smallest examined brooding fish is 138.5 mm SL. Pouch eggs are usually in one layer and in 2-4 transverse rows. One male (138.5 mm SL) has two rows of 16 eggs throughout the 16-ring pouch, while another (150 mm SL) has 4 rows of 22 eggs throughout 16 pouch rings.

Total rings number 60-63 (usually 61-62) in specimens from Victoria and Tasmania, whereas this count is 59-62 (usually 59-61) in fish from South Australia and Western Australia. Present data show no other evidence of geographic variation in meristic values.

Distribution: Known from Victoria (Port Phillip Bay and vicinity), South Australia (including Kargaroo I.), Northern Tasmania, and Western Australia (Flinders Bay to Rottnest I.). All collections are from inshore areas to depths of 11 m, and were made in tidepools, over sand and rocks, and among *Zostera* sp. and *Posidonia* sp.

Material examined: One hundred and twenty-five specimens, 25.5-182 mm SL, including presumptive holotype.

Presumptive Holotype: MNHN A.982 (116.5, female or juvenile male), Gulf St. Vincent, trawl, Waterhouse col.

Other material: Australia, Vic.: AMS I.19777-008 (3, 93.5-153), AMS I.19830-001 (1, 87), AMS I.19921-008 (2, 164.5-170), AMS I.21643-004 (2, 144-145), GCRL 17353 (1, 83.5), GCRL 17354 (1, 101.5), GCRL 17372 (4, 96-146.5), NMV A.233 (1, ca. 102), NMV A.662 (1, 151), NMV A.677 (2, 118-146), NMV A.1988 (2, 138-139), SMNS 1810 (105, juvenile, holotype of *Syngnathus caretta*). S.A.: AMS I.17615-006 (3, 47.5-71.5), AMS I.20160-029 (1, 82), AMS I.20162-007 (10, 63-140), AMS I.20171-010 (1, 82.5), AMS I.20180-019 (5, 107.5-142.5), AMS I.20183-002 (7, 41-92.5), AMS I.20189-022 (1, 130.5), GCRL 14817 (1, 147.5), MCZ 52107 (1, 135), SAM F.691 (71, juvenile, paratype of *S. vercoi*), SAM F.692 (1, ca. 137), SAM F.3180 (1, 101.5), SAM F.3631 (6, 45.5-153), SAM F.3919 (9, 25.5-81.5), SAM F.3921 (1, 83), SAM F.3922 (1, 33.5), SAM F.4156 (1, 77). Tas.: GCRL 14797 (20, 115.5-152), QVM 1972/5/527 (8, 85-138.5), QVM 1976/5/157 (1, 100.5), QVM 1976/5/159 (3, 75-80), TFDA uncat. (2, 87-152), USNM 217817 (1, 77), USNM 217818 (4, 56-138), WAM P.27562-003 (2, 57-57.5). W.A.: GCRL 16266 (4, 144.5-182), QM I.13456 (1, 94), WAM P.24431-3 (3, 70-105.5), WAM

P.25702-001 (1, 46), WAM P.25752-005 (1, 141.5), WAM P.25761-006 (1, 142.5).

Kaupus Whitley

Kaupus Whitley, 1951b: 392 (as subgenus of *Leptonotus* Kaup; type-species by original designation: *Leptonotus costatus* Waite and Hale, 1921).

Diagnosis: Median dorsal snout ridge low, not a high plate-like process extending above horizontal through dorsal rim of orbit, confluent behind with anterior continuations of supraorbital ridges; opercular ridge straight, crosses half or more of operele in subadults-adults; other head ridges distinct but not elevated strongly; with or without prominent ridges on pectoral-fin base; dorsum of body flat to a little depressed between superior ridges; principal body ridges distinct, superior trunk ridge not arched dorsad on subdorsal rings; scutella without longitudinal keel-like ridges; dorsal-fin origin on trunk, fin-base not elevated; trunk rings 16-18; total rings 51-56; dorsal-fin rays 30-36; total subdorsal rings 8.0-9.25; pectoral-fin rays 9-11; anal-fin rays 3-4; trunk depth of adult females much greater than that of adult males; pouch plates present; pouch closure the everted type (Fig. 1).

Comparisons: The combination of a prominent opercular ridge, 9-11 pectoral-fin rays, an exceptionally deep trunk in adult females, presence of pouch plates and everted pouch closure, together with absence of elevated snout ridge and dorsal-fin base distinguishes *Kaupus* from other genera treated here.

Remarks: *Kaupus* and its type-species, *Leptonotus costatus*, have usually been referred to *Leptonotus* Kaup 1853, but *Kaupus* lacks the confluent lateral trunk and tail ridges characteristic of that genus (Fig. 2a). *Kaupus* further differs in having the median dorsal snout ridge confluent with the supraorbital ridges (snout ridge ends on interorbital in *Leptonotus*), and in having well-developed pouch plates and a prominent ridge on the operele (both absent in *Leptonotus*). These differences are sufficient for recognition of *Kaupus* as a monotypic endemic Australian genus.

Kaupus costatus (Waite and Hale)

Figure 9, Plate 5

Leptonotus costatus Waite and Hale, 1921: 301, fig. 43 (orig. descr.; Spencer Gulf, S.A.); McCulloch, 1929: 85 (compiled); Scott, 1939: 141 (characters in key); Whitley, 1951b: 392 (type-species of *Kaupus*); Munro, 1958: 85, fig. 588 (characters); Scott, 1962: 116, fig. (in key, characters); Scott et al., 1974: 136, fig. (in key, characters); Glover, 1976: 171 (compiled); Scott, 1977: 123 (nomenclatural note); Glover, 1979: 147, 150, fig. 7i (among vegetation; Kangaroo I., S.A.).

Leptonotus (*Kaupus*) *costatus*. Whitley, 1951b: 392 (n. comb.; comparisons); Whitley and Allan, 1958: 59 (listed); Whitley, 1964: 37 (listed).

Kampus (sic) *costatus*. Coleman, 1980: 87, col. pl. (n. comb., ecol. notes).

Kaupus costatus. Dawson, 1982: 11, 40 (note on brood pouch, comparisons); Last et al., 1983: 298, 302, Fig. 27.9 (in key, descr., range, in part).

Diagnosis: See that of genus.

Description: Rings 16-18 + 35-38, dorsal-fin rays 30-36, subdorsal rings 5.75-4.25 + 2.5-4.5 = 8.0-9.25, pectoral-fin rays 9-11 (modally 10), see Tables 1-8 for additional counts. Proportional data, based on 22 specimens 43.5-127.0 ($\bar{x} = 74.3$) mm SL, follow: HL in SL 7.8-9.8 (8.7), snout length in HL 2.5-3.1 (2.8), snout depth in snout length 1.8-3.1 (2.3), length of dorsal-fin base in HL 0.7-0.9 (0.8), anal ring depth in HL 3.0-4.4 (3.9), pectoral-fin length in HL 4.0-5.5 (4.5). Trunk depth in HL in mature males 2.3-2.9 (based on 4, 87.5-127 mm SL), in mature females 1.1-1.5 (based on 3, 106-115 mm SL).

Colouration: Adult males and subadults tan to brownish, sometimes with a narrow, near-black, midlateral stripe on anterior half or more of tail. Adult females sometimes with a pale stripe on opercular ridge, with brown streaks, bars and small ocelli above lateral trunk ridge, and with prominent brown bars (blue in life) below lateral ridge on each trunk ring; dorsum brownish shading to pale distally;

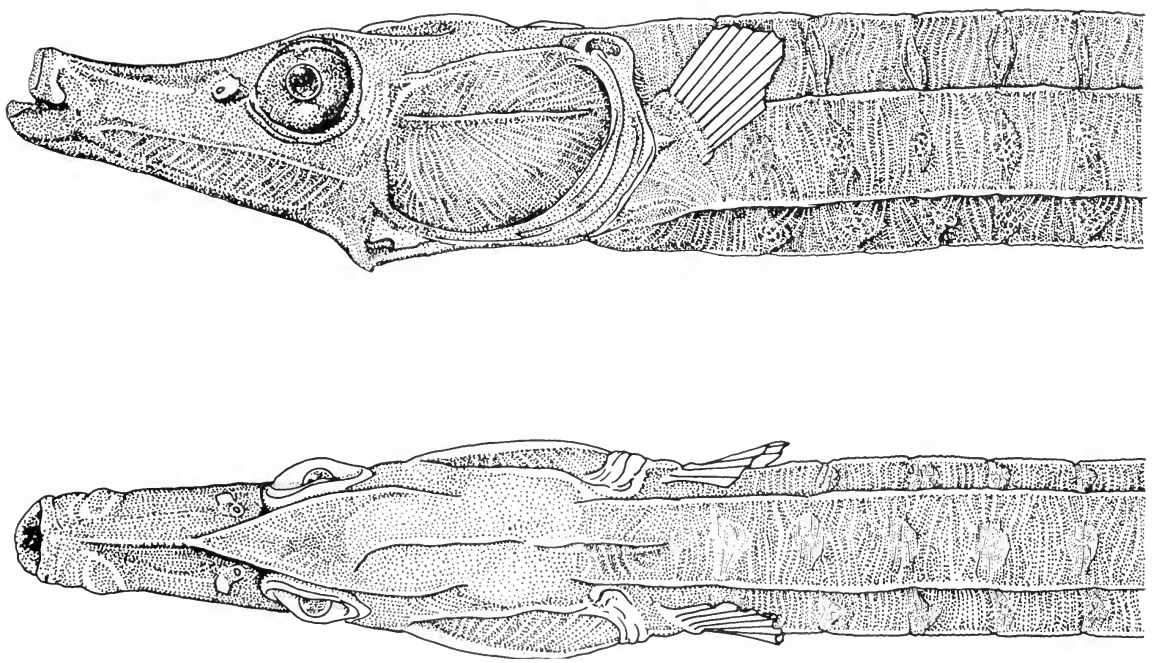


Figure 9. *Kaupus costatus*. Lateral and dorsal aspects of head and anterior trunk rings. From adult male, 87.5 mm SL (AMS I.20177-012).

venter mainly pale throughout; fins shaded lightly with brown.

Remarks: The holotype (SAM F.693) is now faded in preservative, the dorsal and pectoral fins are damaged and the caudal-fin rays cannot be counted accurately. Although not listed as paratypes by Glover (1976), seven specimens (SAM F.695) collected by P. Geisler in Gulf St. Vincent and discussed by Waite and Hale (1921), should also be considered paratypes. I have examined the smallest specimen in this lot (67.5 mm SL). The remaining paratype (SAM F.694) is now damaged and in very poor condition.

Frequency of caudal-fin rays is a stable character in most genera of pipefishes and numbers of fin-rays are typically 8, 9, 10 or 11 in non-regenerated specimens. Among 37 specimens of *K. costatus*, without evidence of tail regeneration, caudal-fin rays number 7 (in 2), 8 (3), 9 (17), 10 (15). These limited data suggest that, unlike other pipefishes, frequency of caudal-fin rays is variable in this species.

An immature male (72 mm SL) has traces of developing pouch folds under 11 tail rings and 7 mature fish (86.5-127 mm SL) have the brood pouch developed below 12-14 rings. Pouch eggs are deposited in one layer and in 2-4 transverse rows, and occasional specimens have the pouch folds fused on the 2-3 distal pouch rings. One male (97 mm SL) has a total of 17 pouch eggs deposited in two rows through 11 of 13 pouch rings and another (113.5 mm SL) has ca. 52 eggs in four rows in the 13-ring pouch. Near term brood-pouch young are 12-15 mm TL.

Present materials show no evidence of geographic variation.

Distribution: Known from Bruthen Creek, Victoria (146°50'E), from South Australia (including Kangaroo I.), and from Flinders I., Tasmania. Coleman (1980) notes occurrence over seagrass and algal beds in depths of 1-50 m. Present records include one seine collection in 0-3 m.

Material examined: Forty-one specimens, 18.5-129 mm SL, including holotype and two paratypes.

Holotype: SAM F.693 (115.0, adult female),

Spencer Gulf, S.A., dredged, 7 Dec. 1920, J. Verco.

Paratypes: SAM F.694 (damaged female), taken with holotype. SAM F.695 (1, 67.5), Gulf St. Vincent, S.A., 1920, P. Geisler.

Other material: Australia, Vic.: AMS I.21407-002 (1, 72). S.A.: AMS I.20177-012 (6, 28.5-87.5), AMS I.20178-009 (5, 18.5-79), AMS I. 20179-018 (1, 66.5), AMS I.20184-003 (4, 103.5-127), GCRL 14819 (2, 54.5-56.5), GCRL 16275 (2, 70-97), NMV A.301 (1, 85.5), NMV A.302 (1, 113.5), NMV uncat. (1, 129), SAM F.3296 (1, 61.5), SAM F.3920 (4, 42-60.5), SAM F.3923 (1, 90.5), SAM F.4165 (6, 39-107). Tas.: TFDA uncat. (2, 74.5-96.5).

Mitotichthys Whitley

Mitotichthys Whitley, 1948c: 75 (type-species by original designation: *Syngnathus tuckeri* Scott, 1942).

Diagnosis: Median dorsal snout ridge low, not a high plate-like process extending above horizontal through dorsal rim of orbit, usually terminating on anterior half of interorbital; supraopercular ridge absent; opercular ridge typically vestigial or absent in subadults-adults, sometimes persistent on anterior third of opercle; other head ridges low or obsolete; usually without well-developed ridges on pectoral-fin base; dorsum of trunk a little convex, sloped upward on subdorsal rings; dorsum of tail convex to a little depressed between superior ridges; superior trunk ridge arched a little dorsad on subdorsal rings; scutella without keel-like ridges; dorsal-fin origin on trunk, anterior half or more of fin-base elevated; trunk rings 19-23, total rings 54-70; dorsal-fin rays 25-40; total subdorsal rings 7.0-12.75; pectoral-fin rays 10-14 (except 18 in *M. mollisoni*); anal-fin rays 2-4; trunk depth of adult females somewhat greater than that of adult males; pouch plates absent or vestigial; pouch closure the everted type (Fig. 1) though unknown in *M. meraculus* and *M. mollisoni*.

Comparisons: The combination of 19-23 trunk rings, absence of well-developed opercular ridge and absence of an elevated snout ridge, together with presence of an elevated dorsal-fin base and everted pouch closure, distinguishes *Mitotichthys* from other treated genera.

Remarks: This endemic Australian genus is here considered to include four species. However, two (*M. meraculus, M. mollisoni*) are known from a total of three specimens, and their referral to *Mitotichthys* is provisional.

Although brood-pouch plates are usually absent, vestiges of plates were observed concealed within the dorsal margins of the rather fleshy pouch folds of some specimens of *M. tuckeri* and *M. semistriatus*.

KEY TO THE SPECIES OF *MITOTICHTHYS*

1a. Dorsal-fin rays 25-28 2
1b. Dorsal-fin rays 35-40 3
2a. Tail rings 34-35; pectoral-fin rays 13 ..... *meraculus*
2b. Tail rings 44; pectoral-fin rays 18 *mollisoni*
3a. Subdorsal trunk rings 10.0-7.5; tail rings 40-43 ..... *tuckeri*
3b. Subdorsal trunk rings 4.0-2.75; tail rings 46-50 ..... *semistriatus*

Mitotichthys tuckeri (Scott)

Figure 10, Plate 6

Syngnathus tuckeri Scott, 1942: 17, pl. 5, figs. 1-3 (orig. descr.; Bridport, Tas.); Whitley, 1948c: 75 (type-species of *Mitotichthys*); Scott, 1955: 135 (characters in key); Munro, 1958: 82, fig. 568 (characters); Scott, 1961: 59 (characters in key); Scott, 1964: 93 (synon., descr., comparisons with *S. curtirostris*); Green, 1974: 4 (compiled); Dawson, 1978c: 417, fig. 3 (descr.; Twofold Bay, N.S.W.); Kähsbauer, 1978: 314 (counts, N.S.W.); Scott, 1980: 106 (listed); Last et al. 1983: 298, 313, Fig. 27.25 (in key, descr., range).

Mitotichthys tuckeri. Whitley, 1948c: 75 (n. comb., type-species of *Mitotichthys*); Whitley and Allan, 1958: 59 (listed); Scott, 1960: 87 (synon., descr.); Whitley, 1964: 37 (listed); Scott, 1971: 123 (note on breeding season); Scott, 1975: 134 (synon., notes on generic status and breeding season).

Diagnosis: Subdorsal tail rings <4; dorsal-fin rays 35-38; pectoral-fin rays usually 11.

Description: Rings 21-23 + 40-42, dorsal-fin rays 35-38, subdorsal rings 10.0-7.5 +

1.5-3.25 = 10.0-12.75, pectoral-fin rays 10-12, see Tables 1-8 for additional counts. Proportional data, based on 9 specimens 76.0-159.0 ($\bar{x}$ = 128.1) mm SL, follow: HL in SL 6.5-7.9 (7.3), snout length in HL 1.8-2.1 (1.9), snout depth in snout length 4.6-7.2 (5.9), length of dorsal-fin base in HL 0.9-1.2 (1.0), anal ring depth in HL 5.0-6.6 (5.6), pectoral-fin length in HL 4.1-5.8 (4.7). Trunk depth in HL in mature males 4.0-5.2 (4, 121.5-133.5 mm SL), in mature females 2.8-3.7 (3, 149.5-159 mm SL).

Colouration: Tan, without distinctive markings. Head and body irregularly shaded with brownish microchromatophores, somewhat darker on dorsum and upper part of side; dorsal and pectoral fins hyaline or sprinkled with microchromatophores; caudal fin brownish, shading to dark brown distally.

Comparisons: See key and diagnosis. This species is perhaps most similar to *M. semistriatus* from which it is readily distinguished by the more anterior dorsal-fin origin (on 10-7.5 trunk rings versus 4-2.75 in *M. semistriatus*), and absence of prominent markings on head and body (present in *M. semistriatus*).

Remarks: Some descrepancies in the original description have been noted previously (Dawson, 1978c), and present ranges for meristic features reflect data of Scott (1960, 1964) for four specimens that I have not examined.

Among present material, the brood pouch extends below 11-12 tail rings in four males (99-149 mm SL), and pouch eggs are deposited in a single layer of 3-6 transverse rows. One fish (131.5 mm SL) has ca. 100 eggs arranged in three rows through 9 of 11 pouch rings.

Present materials show no evidence of significant geographic variation.

Distribution: Known from Twofold Bay, New South Wales and from Cam River Beach to Swansea, Tasmania. Although one sample was evidently trawled in 9.1-27.4 m, the holotype and most other specimens appear to be from "shallow water". As this species is poorly represented in collections, its ecological requirements are not known.

Material examined: Eleven specimens, 76-159 mm SL, including holotype.

Holotype: QVM 1971/5/28, orig. 1941.16 (121.5, brooding male), Bridport, Tas., G. V. Tucker col.

Other material: Australia, N.S.W.: CAS-SU 36427 (2, 133.5-159), CSIRO A.1645 (1, 149.5), CSIRO A.1646 (1, 126). Tas.: GCRL 17037 (3, 131.5-150.5), GCRL 17038 (1, 149.5), QVM 1975/5/110 (2, 76-99).

Mitotichthys semistriatus (Kaup)

Plate 7

Leptonotus semistriatus Kaup, 1853: 233 (nomen nudum); Kaup, 1856: 48 (orig. descr.; loc. unknown); Duméril, 1870: 582 (descr. compiled); Duncker, 1915: 89 (synon., descr.; S.A., Tas.); Lord, 1923: 64 (listed); Lord and Scott, 1924: 40 (fairly common, Tas.); Lord, 1927: 13 (listed); McCulloch, 1929: 85 (compiled); Mack, 1934: 180 (listed); Scott, 1939: 139, 141, 144, fig. 1 (characters in key, descr.); Scott, 1953: 149, fig. 3 (descr.); Munro, 1958: 85, fig. 589 (characters, range); Whitley and Allan, 1958: 59 (listed); Scott, 1961: 58 (characters in key); Scott, 1962: 116, fig. (in key, notes); Scott, 1963: 16, figs. 4a-b (descr., colour notes, to 267.5 mm SL); Whitley, 1964: 37 (listed); Scott et al., 1974: 136, fig. (in key, notes); Dawson, 1978b: 292 (name only); Fritzsche, 1980: 192 (compared with *L. blainvilleanus*); Scott, 1980: 106 (listed); Develius, 1981: 320 (colour figs.); Last et al., 1983: 298, 303, Fig. 27.11 (in key, descr., range, in part).

Syngnathus verreauxianus Duméril, 1870: 568, 573 (in key, orig. descr., Tas.); Duncker, 1915: 89 (= *L. semistriatus*); Bertin and Estéve, 1950: 49 (holotype listed).

Syngnathus semifasciatus. Günther, 1870: 162 (n. comb., substitute name, descr.); Macleay, 1882: 288 (descr., range); Johnston, 1883: 134 (not uncommon, Tas.); Johnston, 1890: 37 (compiled); Lucas, 1890: 38 (listed); Duncker, 1909: 244 (characters, perhaps a local variety of *S. blainvillianus*); Waite, 1911: 174 (compared with *S. norae*); Duncker, 1915: 89

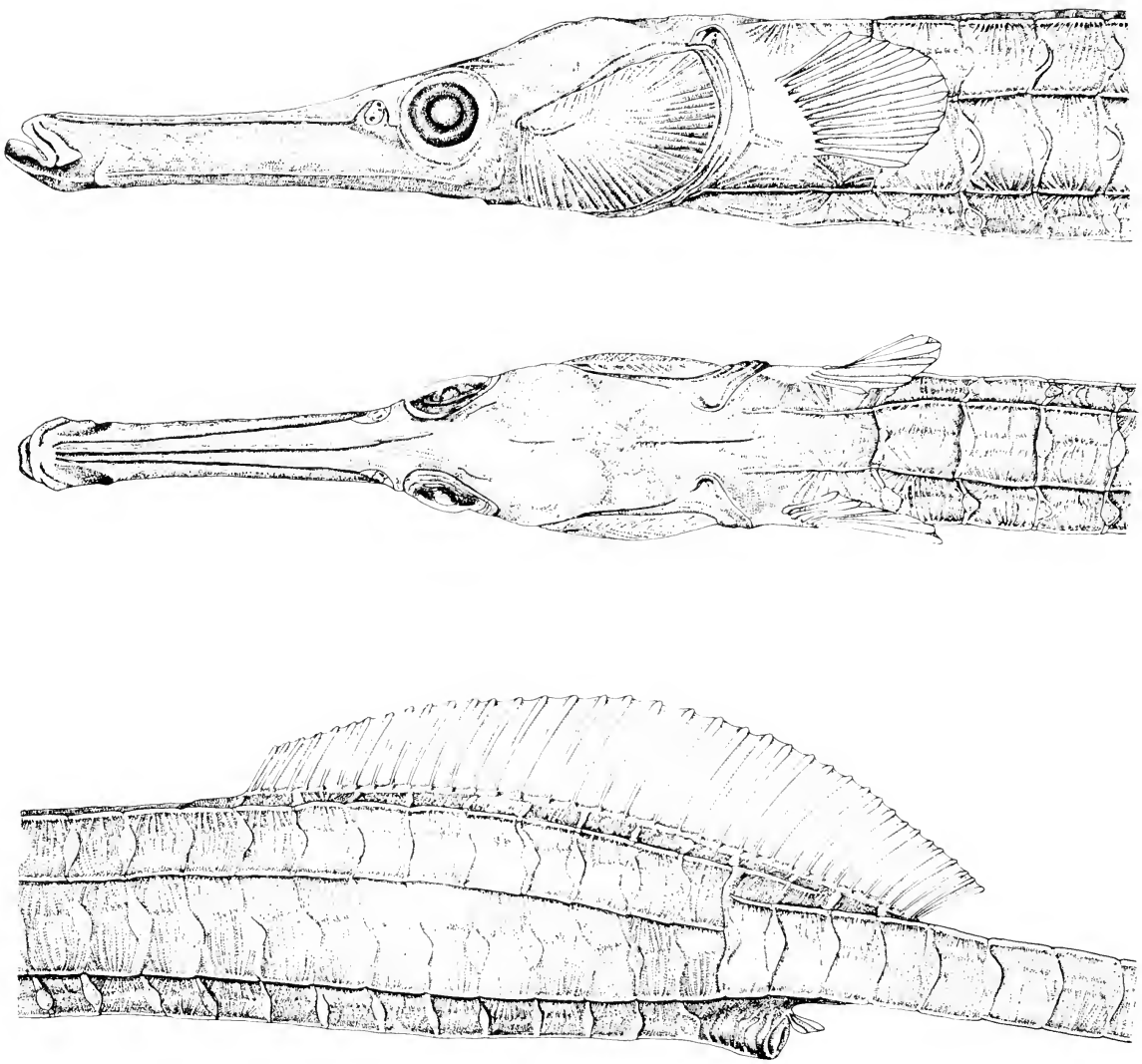


Figure 10. *Mitotichthys tuckeri*. Lateral and dorsal aspects of head and anterior trunk rings, together with lateral section of body illustrating configuration of principal ridges and fin positions. From adult female, 149.5 mm SL (GCRL 17038).

(= *Leptonotus semistriatus*); Dawson, 1978b: 292 (name only).

Syngnathus semistriatus. Castelnau, 1872b: 199 (n. comb., colour descr.); Waite, 1911: 174 (compared with *S. norae*); Fowler, 1907: 426 (incorrectly recorded from Fiji); Duncker, 1915: 89 (= *Leptonotus semistriatus*); Whitley, 1927: 4 (compiled from Fowler, 1907); Fowler, 1931: 324 (compiled from Whitley, 1927).

Syngnathus semi-fasciatus. Lucas, 1891: 9 (emendation, colour note).

Leptonotus tristriatus Fowler, 1922: 444, fig. 1 (orig. descr., "Fiji"; locality in error, probably Vic.); Herald, 1953: 231 (status uncertain); Fowler, 1959: 138 (synon., descr.).

Syngnathus tristriatus. Fowler, 1928: 113, fig. 24 (n. comb., characters).

Leptonotus semifasciatus. Scott, 1977: 123 (n. comb., name only).

Diagnosis: Subdorsal tail rings >4; dorsal-fin rays 36-40; pectoral-fin rays usually 13.

Description: Rings 19-20+46-50, dorsal-fin rays 36-40, subdorsal rings 4.0-2.75+6.25-7.5=9.25-10.75, pectoral-fin rays 12-14, see Tables 1-8 for additional data. Proportional data, based on 12 specimens 88.0-231.0 ($\bar{x}$=135.9) mm SL, follow: HL in SL 6.6-7.3 (6.9), snout length in HL 1.6-1.9 (1.8), snout depth in snout length 6.1-10.9 (8.1), length of dorsal-fin base in HL 1.2-1.4 (1.3), anal ring depth in HL 5.0-6.9 (5.9), pectoral-fin length in HL 6.4-9.8 (7.9). Trunk depth in HL in mature males 4.5-5.5 (3, 139.5-160 mm SL), in mature females 2.8-4.2 (7, 141-184 mm SL).

Colouration: Dorsum of head and predorsal region of trunk pale to tan with an irregular median dark brown stripe from area above nares to the dorsal fin, where it divides to continue, bilaterally, along or around the fin-base; side of head with a broad brown stripe from near rear of gape to rear of opercle, with a dark-margined pale stripe below, and with the lower part of head shading from tan to pale ventrad; venter of trunk mainly pale; sides and dorsum of tail largely brown, venter brown to pale; dorsal- and pectoral-fin rays edged with brown; caudal fin brownish. Adult males with a pale stripe on pectoral-fin base, upper half of side of trunk dark brown with a few minute, dark-margined ocelli, and lower half of trunk pale or tan. Lateral trunk and tail ridges marked with a series of oval pale blotches and a few indistinct ocelli on side of tail. In some fish, the pale inferior ridge expands to a broad pale stripe along upper portion of brood pouch, and principal ridges are pale on the anterior half or more of tail. Mature females with several irregular rows of dark-margined ocelli in dark stripe above lateral trunk ridge, a narrow brown bar on lower part of side of each trunk ring, and lateral trunk and tail ridges sometimes pale. Most of these markings may fade with preservation, but the dark-margined pale stripe persists on the snout of most specimens examined.

Comparisons: See key, diagnosis, and this section under *M. tuckeri*.

Remarks: Kaup (1853, 1856) stated that the original locality of the holotype was unknown. Günther (1870) later noted that this specimen was labeled "South Australia," but this should probably be interpreted as southern Australia. Kaup (1856) described the holotype (BMNH 1980.9.11.1) as having 19+48 rings, 3+7 subdorsal rings, 38 dorsal-fin rays and 12 pectoral-fin rays. Some of these values are correct, but I find this fish to have 3+6.5 subdorsal rings, 13 rays in the left pectoral fin and 14 in the right. Furthermore, the lateral ridge configuration is anomalous on the left side, wherein the lateral tail ridge continues anterodorsad to unite with the superior trunk ridge near a vertical through dorsal-fin origin.

Although included in *Leptonotus* by Kaup (1856), this species lacks the confluent lateral trunk and tail ridges, characteristic of *Leptonotus* (Fig. 2a), and is referred to *Mitotichthys* owing to its agreement in diagnostic features and general morphology.

The brood pouch extends below 17-18 tail rings in four males (139.5-160 mm SL), the largest of which has 41 eggs in a single layer of ca. four transverse rows through 13 of 18 pouch rings.

Present materials show no evidence of significant geographic variation.

Distribution: Known from Port Phillip Bay and Westernport Bay, Victoria and from Tasmania (Woolnorth to Flinders I. and Port Arthur). The few useful data available indicate collections from among "seagrass" and "eelgrass" in depths of less than 10 m.

Material examined: Thirty-five specimens, 88-231 mm SL, including holotype.

Holotype: BMNH 1980.9.11.1 (231, adult female), loc. uncertain, probably southern Australia.

Other material: Australia, Vic.: AMS I.19759-007 (1, 173), AMS I.19785-001 (2, 88-93), AMS I.19835-001 (3, 123.5-158.5), AMS I.19921-007 (1, 175), AMS IA.2615 (5, 101-133), GCRL 16866 (3, 116-153), GCRL 17357 (5, 145.5-196), GCRL 17448 (1, 154), NMV A.553 (1, 139.5), NMV A.548 (1, 212), UM uncat. (3, 88-129.5). Tas.: AMS I.22529-001 (2, 155.5-193.5), MNHN 6111

(115.5, female or juvenile male, holotype of *Syngnathus verreauxianus*). TFDA uncat. (5, 109.5-174).

Mitotichthys meraculus (Whitley)

Plate 7

Histiogamphelus meraculus Whitley, 1948a: 271 (orig. descr.; City Beach, near Perth, W.A.); Whitley, 1948b: 14 (listed); Whitley, 1955: 155, fig. 3 (holotype figured); Munro, 1958: 86, fig. 592 (characters); Whitley and Allan, 1958: 61 (listed); Anon., 1963: 35 (compiled); Whitley, 1964: 38 (listed); Whitley, 1966: 45, fig. (fig. only); Scott, 1980: 110 (name only).

Diagnosis: Subdorsal tail rings <4; dorsal-fin rays 25; pectoral-fin rays 13.

Description: Rings 20+34-35, dorsal-fin rays 25, subdorsal rings 4.0-3.75+3.25-3.5= 7.0-7.5, pectoral-fin rays 13. Measurements (mm) from an adult female specimen (WAM P.25598) follow: SL 184.5, HL 23.3, snout length 12.4, snout depth 2.6, length of dorsal-fin base 17.3, anal ring depth 4.8, trunk depth 8.0.

Colouration: Ground colour of a somewhat faded adult female light brown; dorsal and pectoral fins hyaline; dorsum and venter of body and much of side of tail without persistent markings. Lateral scutella of each trunk ring with a small, dark-margined pale ocellus; each ring with a median vertical series of two additional ocelli above lateral trunk ridge and one below. Lower ocelli modified to form elongate pale bars on the 2-3 anterior tail rings. Two median caudal-fin rays brown to tips, remainder of fin brownish, margined above and below by a rather broad pale band.

Comparisons: In addition to characters in the key and diagnosis, this species differs from congeners in having the pectoral-fin base protruding slightly laterad, and the median dorsal snout ridge ending on the posterior half of the interorbital (usually on anterior half in congeners).

Remarks: This species is presently known only from the dried holotype (WAM P.1215) and the specimen described above. Relationships are uncertain due to the lack of adequate material (especially adult males), but absence of an elevated, plate-like, median dorsal snout ridge dictates removal from the genus *Histiogamphelus*. Pending study of additional material, I provisionally refer *H. meraculus* to the genus *Mitotichthys*.

Distribution: Known only from the vicinity of Perth and from East Flinders Bay (near Augusta), Western Australia.

Material examined: Two specimens, ca. 184.5-222 mm SL, including holotype.

Holotype: WAM P.1215 (ca. 222, dried adult female), City Beach, near Perth, W.A., J. Kirk col.

Other material: Australia, W.A.: WAM P.25598 (1, 184.5).

Mitotichthys mollisoni (Scott)

Syngnathus mollisoni Scott, 1955: 131, fig. 2 (orig. descr.; Bivouac Bay, Tasman Peninsula, Tas.); Munro, 1958: 82, fig. 570 (characters); Scott; 1961: 58 (characters in key); Scott, 1968: 6 (listed); Scott, 1970: 35 (ref.); Green, 1974: 4 (holotype missing); Scott, 1980: 106 (listed); Last et al., 1983: 298, 311, Fig. 27.22 (in key, descr.).

Novacampus mollisoni. Whitley and Allan, 1958: 59 (n. comb., listed); Whitley, 1964: 38 (listed).

Diagnosis: Subdorsal tail rings >4; dorsal-fin rays 28; pectoral-fin rays 18.

Description: Rings 20+44, dorsal-fin rays 28, subdorsal rings 2.8+7=9.8, pectoral-fin rays 18, anal fin "minute," caudal-fin rays 6. Measurements (mm) of holotype follow: SL 159.2, HL 24.8, snout length 15.0, snout depth 2.3, trunk depth 5.1, pectoral-fin length 2.1.

Colouration: Brownish, without distinctive markings, except for a dark-margined pale stripe on side of snout and opercle.

Comparisons: See key and diagnosis.

Remarks: This species was described from a single female or immature male specimen which was entangled in a handline fished in 45.7 m. The holotype, reported missing by Green (1974), has not since been located and the pre-

sent information is based on the original description.

As noted in Remarks under *Kaupus costatus*, the presence of 6 caudal-fin rays is atypical in pipefishes, and suggests that the caudal fin was regenerated in the holotype of *Syngnathus mollisoni*. Thus, typical specimens may be expected to have 10 caudal-fin rays and a few more than 44 tail rings. In general morphology, this species appears most similar to *M. tuckeri* and *M. semistriatus*, and it shares the dark-margined, pale, lateral stripe on the head with *M. semistriatus*. *Mitotichthys mollisoni* and *M. semistriatus* overlap in numbers of trunk rings and subdorsal rings (Tables 1, 6-8) and overlap or agree closely in comparable proportional values, while the described number of tail rings of *M. mollisoni* is only two fewer than the minimum recorded for *M. semistriatus*. *Mitotichthys mollisoni* differs principally in having fewer dorsal-fin rays (28 versus 36-40 in *M. semistriatus*), and in having more pectoral-fin rays (18 versus 12-14 in *M. semistriatus*).

Status and relationships are uncertain, but, pending study of additional material (including adult males), this species is provisionally referred to *Mitotichthys* due to its general conformity with the generic diagnosis and apparent similarity with *M. tuckeri* and *M. semistriatus*. Whitley and Allan's (1958) referral of this species to *Novacampus* Whitley (a junior synonym of *Leptonotus*), characterized by confluent lateral trunk and tail ridges, is untenable.

Histiogamphelus McCulloch

Histiogamphelus McCulloch, 1914: 30 (type-species by original designation: *Histiogamphelus briggsii* McCulloch, 1914).

Diagnosis: Median dorsal snout ridge high, plate-like, its dorsal margin elevated to or above a horizontal through dorsal rim of orbit, terminating on interorbital or confluent with frontal ridge; supraopercular ridge vestigial or absent; opercle with a complete longitudinal ridge in juveniles (<40 mm SL), the ridge usually vestigial or obsolete in adults; dorsum of trunk flat to a little convex, usually sloped upward on subdorsal rings; dorsum of tail flat to a little depressed between superior ridges; pectoral-fin base protruding a little laterad, usually with two low ridges; principal body ridges distinct, the superior trunk ridge usually arched a little dorsad on subdorsal rings; scutella without keel-like ridges; dorsal-fin origin on trunk, the anterior half or more of fin-base a little elevated; caudal fin usually lanceolate, the median rays a little longer than those above and below; trunk rings 18-22; total rings 47-58; dorsal-fin rays 23-28; total subdorsal rings 6.5-8.25; pectoral-fin rays 11-14; anal-fin rays 3-4; trunk depth of adult females somewhat greater than that of adult males; pouch plates rudimentary or absent; pouch closure the everted type (Fig. 1).

Comparisons: The high, plate-like, median dorsal snout ridge distinguishes *Histiogamphelus* from other genera treated here.

Remarks: The characteristic snout ridge is developed in small specimens (35-40 mm SL), which also have the posterior angles of the trunk rings and some tail rings elevated and produced to points. There is considerable intraspecific variation in the dorsolateral profile of the snout, but the snout ridge is high in all specimens examined. Pouch plates are absent in some males, but others have rudimentary plates, angled laterad from the vertical axis of the tail, obscured within the dorsal margins of the membranous pouch folds.

Relationships are presently uncertain, but *Histiogamphelus* appears to be most closely related to *Mitotichthys*. Although clearly differing in the morphology of the snout, these taxa lack a well-developed opercular ridge in subadults-adults, have relatively high numbers of trunk rings (18-23), and share the elevated dorsal-fin base and everted pouch closure.

Of the three species currently placed in the genus *Histiogamphelus*, I refer one (*H. meraculus* Whitley) to the genus *Mitotichthys* and I retain the remaining two endemic Australian species in *Histiogamphelus*.

KEY TO THE SPECIES OF *HISTIOGAMPHELUS*

1a. Tail rings 33-37; total rings 54-58; median dorsal snout ridge ending on interorbital, not confluent with frontal ridge ..... *briggsii*

1b. Tail rings 28-31; total rings 47-51; median dorsal snout ridge not ending on interorbital, confluent with frontal ridge ..... *cristatus*

Histiogamphelus briggsii McCulloch

Figure 11, Plate 8

Histiogamphelus briggsii McCulloch, 1914: 30, fig. 4 (orig. descr., type-species of *Histiogamphelus*; Thouin or Wineglass Bay, Tas.); McCulloch, 1929: 92 (compiled); Mack, 1934: 180 (Gippsland Lakes, Vic.); Hale, 1939: 2 (compared with *H. maculatus*); Scott, 1939: 139 (characters in key); Whitley and Allan, 1958: 60, fig. 16-3 (listed); Whitley, 1964: 38 (listed); Scott, 1968: 6 (listed); Scott, 1980: 106 (synon., descr., discussion of subspecies); Last et al., 1983: 298, 301, Fig. 27.7 (in key, descr., range, in part).

Histiogamphelus briggsi. Duncker, 1915: 91 (emendation, descr. compiled); Lord, 1923: 64 (listed); Lord and Scott, 1924: 40 (characters); Lord, 1927: 13 (listed).

Histiogamphelus maculatus robensis Whitley, 1948c: 76 (orig. descr.; near Robe, S.A.); Munro, 1958: 86 (characters); Whitley and Allan, 1958: 61 (listed); Whitley, 1959: 310, fig. 2 (fig. only); Scott, 1962: 111, 113, fig. (in key, characters); Whitley, 1964: 38 (listed); Scott, 1974: 128, fig. (in key, characters); Glover, 1976: 171 (compiled); Scott, 1980: 110 (name only).

Histiogamphelus briggsii orae Whitley, 1950: 238 (orig. descr.; Thompson's Bay, Coogee, N.S.W.); Munro, 1958: 85 (characters); Whitley and Allan, 1958: 60 (listed); Whitley, 1964: 38 (listed); Scott, 1980: 107 (= *H. briggsii*).

Histiogamphelus briggsii briggsii. Munro, 1958: 85, fig. 590 (n. comb., characters); Scott, 1980: 107 (comparisons).

Diagnosis: Tail rings 33-37; median dorsal snout ridge ends on interorbital, rounded or emarginate in lateral profile of both sexes.

Description: Rings 20-22 + 33-37, dorsal-fin rays 24-28, subdorsal rings 5.5-4.0 + 2.0-3.5 = 6.75-8.25, pectoral-fin rays 11-14, see Tables 1-8 for additional counts. Proportional data, based on 31 specimens 85.5-225.0 ($\bar{x}$ = 142.9) mm SL, follow: HL in SL 7.6-10.5 (8.7), snout length in HL 1.8-2.6 (2.3), snout depth in snout length 1.7-2.7 (1.9), length of dorsal-fin base in HL 1.0-1.3 (1.1), anal ring depth in HL 3.2-4.5 (3.6), pectoral-fin length in HL 5.0-6.4 (5.4). Trunk depth in HL 1.7-2.2 in adult females (7, 127.5-225 mm SL), 3.0-3.3 in adult males (6, 123-173.5).

Colouration: Adult females tan to dark brown; head, dorsum and venter of body mainly plain. Side of trunk and anterior half or more of tail with irregularly arranged brown spots and dark-margined ocelli numbering 20 or more per ring; those above lateral trunk ridge mostly plain, those below usually smaller and mostly ocellate. In some fish, a few dark spots extend on side of head above the opercle and on dorsum of subdorsal rings. Adult males mainly brown, plain or with irregular pale streaks and blotches on side. Dorsum of body sometimes with 10-11 diffuse pale bars (ca. 1-2 rings wide) continuing ventrad on sides. Adults of both sexes often with tip of snout pale or light tan. Dorsal fin usually with an irregular, narrow, brown stripe along fin-base; fin otherwise often hyaline but fin-rays occasionally shaded with brown. Pectoral fin usually shaded with microchromatophores; caudal fin brown with a pale margin above and below the two median fin-rays. Young fish light tan to brown, tail often lighter or darker than head and trunk.

Comparisons: See key and diagnosis.

Remarks: The holotype of *H. briggsii* was described as having 36 tail rings, 23 dorsal-fin rays and 5 + 2 subdorsal rings, but I find these values to be 35, 24 and 4.75 + 2, respectively.

The descriptions of *H. m. robensis* (Whitley, 1948c) and *H. b. orae* (Whitley, 1950) are both based on single juvenile representatives of *H. briggsii*. These specimens were described as having 8 and 9 caudal-fin rays, respectively, but both have 10 rays. Furthermore, the holotype of *H. m. robensis* has 21 + 35 rings, 25 dorsal-fin rays and 5 + 2.75 subdorsal rings, rather than the described counts of 20 + 36, 24 and 4.5 + 3. Similarly, the holotype of *H. b. orae* has 13 rays in each pectoral fin and 5 + 2.75 sub-

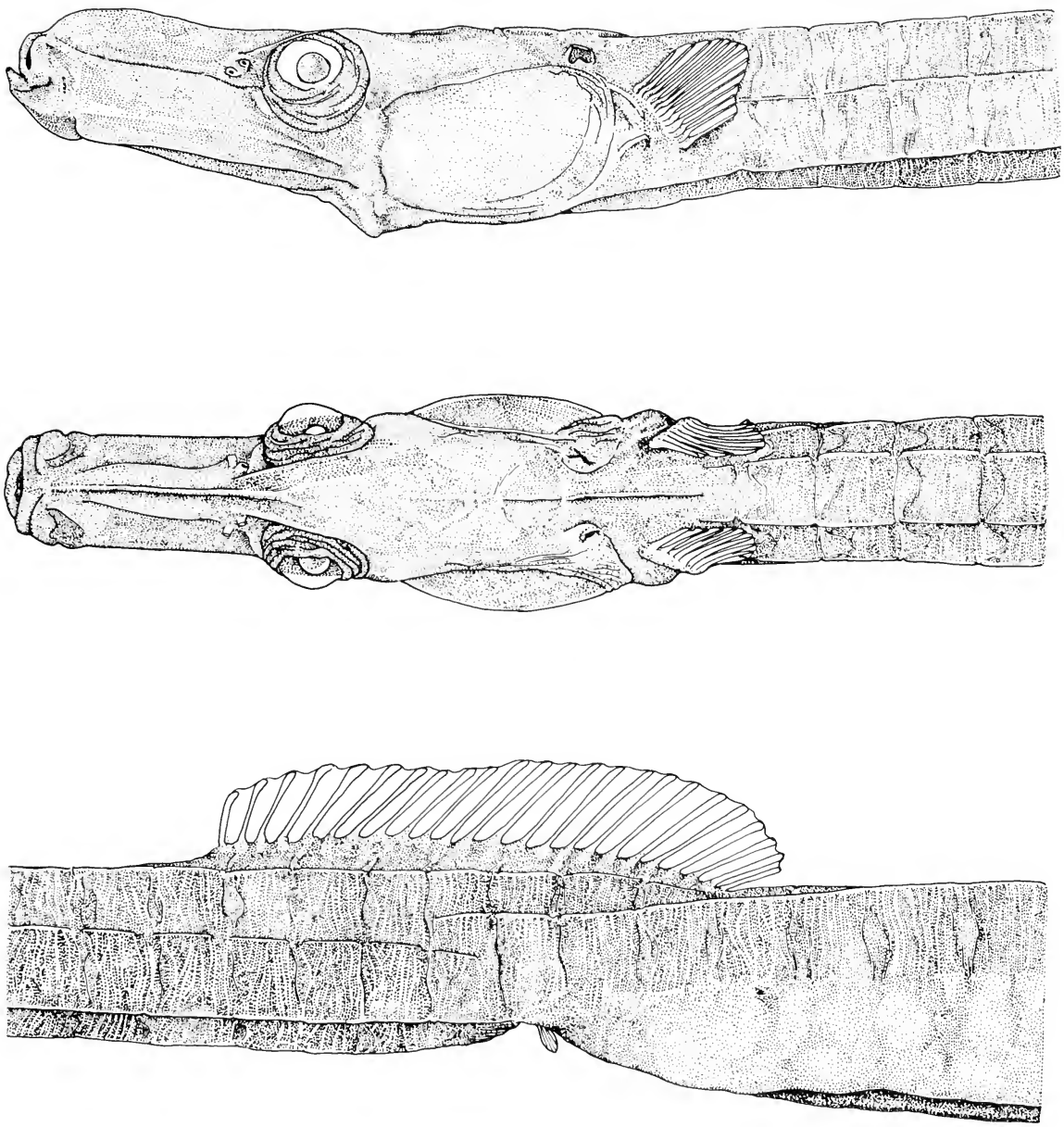


Figure 11. *Histiogamphelus briggsii*. Lateral and dorsal aspects of head and anterior trunk rings, together with lateral section of body illustrating configuration of principal ridges, fin positions, and anterior portion of brood pouch. From adult male, 135 mm SL (GCRL 16338).

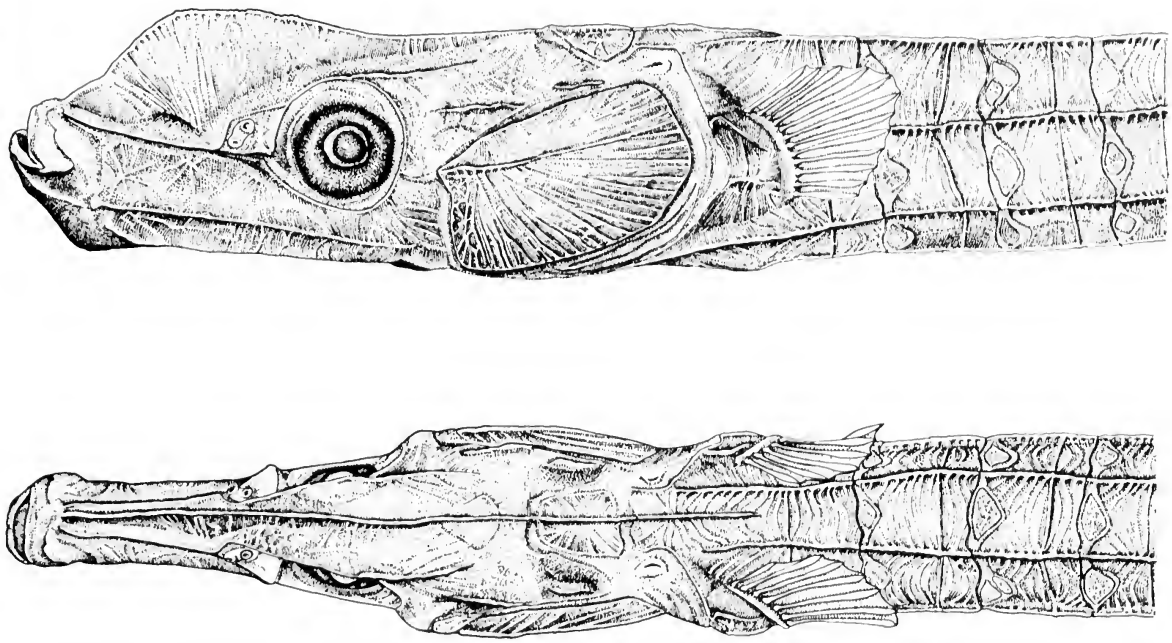


Figure 12. *Histiogamphelus cristatus*. Lateral and dorsal aspects of head and anterior trunk rings. From adult male, 136 mm SL (WAM P.25948-002).

Diagnosis: Tail rings 28-31; median dorsal snout ridge continuous through interorbital and confluent with frontal ridge; lateral profile of snout ridge usually angular in adult males, straight to somewhat rounded in females.

Description: Rings 18-20 + 28-31, dorsal-fin rays 23-26, subdorsal rings 6.0-5.0 + 1.25-2.0 = 6.5-7.5, pectoral-fin rays 11-13, see Tables 1-8 for additional counts. Proportional data, based on 7 specimens 133-187 ($\bar{x}$ = 161.3) mm SL, follow: HL in SL 9.0-11.3 (9.9), snout length in HL 2.4-2.8 (2.6), snout depth in snout length 1.0-1.9 (1.2), length of dorsal-fin base in HL 0.9-1.2 (1.0), anal ring depth in HL 2.8-3.8 (3.4), pectoral-fin length in HL 4.7-6.4 (5.7). Trunk depth in HL 2.2 in one adult female (161 mm SL), 2.6-3.4 in 5 adult males (133-187 mm SL).

Colouration: Study material largely faded in preservative, but most specimens tan or brownish, some retain dark brown spots or streaks on median ventral trunk ridge. Males plain or irregualrly shaded and blotched with dark brown, most with anterior part of snout near-white. Two available adult females pale on anterior part of snout, remainder of head streaked or blotched with dark brown, most trunk rings with a prominent brown blotch above and below lateral ridge, tail generally lighter in colour than the head and trunk.

Comparisons: See key and diagnosis.

Remarks: As noted by Whitley (1948c), the holotype is now largely disintegrated and accurate counts or measurements cannot be obtained. Macleay (1882) described the holotype as having a high, sharp, ridge in front of the eye, 18 + 27 rings, 24 dorsal-fin rays, 5 + 2 subdorsal rings and a length of "four and a half inches" (ca. 110 mm TL). Even though the original description is brief and there is no figure, given characters permit little doubt that the holotype is conspecific with the other specimens treated here.

In juveniles and adult females (Pl. 9), the snout ridge is essentially straight or somewhat rounded in lateral profile, whereas the ridge is higher and more angular in most subadult-adult males. The description of *H. maculatus* (Hale,

dorsal rings, rather than the described values of 12 and 6 + 2.

Early juveniles (Pl. 8) have a relatively low snout ridge, the frontal, nuchal and prenuchal ridges are somewhat elevated, and the posterior angles of most rings are a little elevated and produced to sharp points. In subadults-adults, the snout ridge is higher, other median head ridges are low or vestigial, and the posterior angles of rings are neither elevated nor produced to points. Small fish (<40 mm SL) may have a complete ridge on the opercle. This ridge is usually less distinct and incomplete in specimens of moderate size (ca. 100 mm SL), and is typically vestigial or obsolete in larger fish (e.g. >130 mm SL).

The smallest examined male with evidence of a developing brood pouch is 90.5 mm SL, and the pouch is developed below 13-15 tail rings in 10 others (118-157.5 mm SL). Pouch eggs are deposited in 2-4 layers and in 2-6 transverse rows. One male (135 mm SL) has eggs deposited in 2 layers and 4 rows throughout the 15-ring pouch, and there are 28 eggs in the outer right row.

Present specimens do not show significant geographic variation in meristic values.

Distribution: Known from Sydney to Bermagui, New South Wales, from the Gippsland Lakes and southwestern Bass Strait, Victoria, from the vicinity of Robe, South Australia, and from Binalong Bay (Scott, 1980) and Wineglass Bay, Tasmania.

This species has been taken by a variety of methods and its preferred habitat is uncertain. The holotype and two other specimens were dredged in 16-27.4 m, and another was dredged "80 mi. (144 km) offshore". One male (129 mm SL) was taken in a plankton tow, and a number of juveniles and adults have been taken by divers in 3-20 m among "loose seaweed and floating dead *Zostera*" over fine sand bottom.

Material examined: Thirty-eight specimens, 35-225 mm SL, including holotype.

Holotype: TM D141/13022 (225, adult female), Wineglass Bay, Tas., dredge, 11 fms (20.1 m), 13 Apr. 1914, E. A. Briggs col.

Other material: Australia, N.S.W.: AMS I.18744-001 (2, 35-36.5), AMS I.18745-002 (1, 157.5), AMS I.18783-001 (1, 124), AMS I.19357-001 (11, 86.5-173.5), AMS IA.5631 (1, 109.5), AMS IB.84 (91, juvenile, holotype of *H. b. orae*), CSIRO A.1576 (1, 129), CSIRO A.3276 (1, 158), GCRL 16338 (12, 123-197.5), GCRL 16339 (2, 85.5-130), GCRL 17352 (1, 209.5). Vic.: NMV A.687 (1, 132.5), NMV A.2038 (1, 102). S.A.: SAM F.2611 (87.5, juvenile, holotype of *H. maculatus robensis*).

Histiogamphelus cristatus (Macleay)

Figure 12, Plate 9

Leptoichthys cristatus Macleay, 1882: 296 (orig. descr., W.A.); Stanbury, 1969: 206 (compiled).

Leptoichthys (?*Doryrhamphus*) *cristatus*. Duncker, 1909: 234 (n. comb., descr. compiled).

Histiogamphelus cristatus. McCulloch, 1913: 31 (n. comb., holotype "generally identical with *H. briggsii*"); Duncker, 1915: 92 (synon., descr. compiled); McCulloch, 1929: 92 (compiled); Whitley, 1948b: 14 (listed); Whitley, 1948c: 76 (compared with *H. meraculus*); Munro, 1958: 86 (characters); Whitley and Allan, 1958: 60 (listed); Whitley, 1964: 38 (listed); Scott, 1980: 110 (name only); Glover, 1983: 163 (listed).

Histiogamphelus maculatus Hale, 1939: 2, fig., col. pl. (orig. descr.; Aldinga Bay, Gulf of St. Vincent, S.A.); Whitley and Allan, 1958: 61 (listed); Whitley, 1964: 38 (listed).

Histiogamphelus gallinaceus Hale, 1941: 110, figs. (orig. descr.; Outer Harbour, Gulf St. Vincent, S.A.); Munro, 1958: 86, fig. 596 (characters); Whitley and Allan, 1958: 61 (listed); Scott, 1962: 111, fig. (in key, characters); Whitley, 1964: 38 (listed); Scott et al., 1974: 128, fig. (in key, characters); Glover, 1976: 171 (compiled); Scott, 1980: 110 (name only).

Histiogamphelus maculatus maculatus. Munro, 1958: 86, fig. 594 (n. comb., characters); Scott, 1962: 111, 113, fig. (in key, characters); Scott et al., 1974: 129, fig. (in key, characters); Glover, 1976: 171 (compiled); Glover, 1979: 150 (Kangaroo I., S.A.); Scott, 1980: 110 (name only).

1939) is based on an adult female with a slight emargination in the dorsal edge of the snout ridge, whereas the description of *H. gallinaceus* (Hale, 1941) is of an adult male with a high, angular, snout ridge. Although these fish and two others from South Australia have more tail rings than specimens from Western Australia (31 versus 28-29), there are no substantial differences among examined specimens and I consider *H. maculatus* and *H. gallinaceus* to be conspecific with *H. cristatus*.

The brood pouch extends below 11-14 rings in five adults (133-187 mm SL).

Distribution: Known from Gulf St. Vincent, Spencer Gulf and Kangaroo I., South Australia, and from the Recherche Archipelago, Geographe Bay, off Fremantle, and from Gage Roads (between Fremont and Rottnest I.), Western Australia. Among the examined specimens, several were dredged, one subadult is recorded from 0-5 m, and one juvenile (39.5 mm SL) was taken from "weed beds."

Material examined: Ten specimens, 39.5-187 mm SL, including holotype.

Holotype: AMS I.16286-001, formerly Macleay Mus. F.256A (disintegrated), West Australia.

Other material: Australia, S.A.: AMS I.20180-018 (1, 158); SAM F.2039 (damaged, adult female, holotype of *H. maculatus*), SAM F.2227 (187, adult male, holotype of *H. gallinaceus*), SAM F.4430 (1, 170). W.A.: WAM P.21008 (1, 133), WAM P.21062 (1, 161), WAM P.25343-004 (1, 184), WAM P.25767-004 (1, 39.5), WAM P.25948-002 (1, 136).

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Explanation of Plates

PLATE 1

Parasyngnathus penicillus. Top—GCRL 18542 (female or juvenile male, 97.5 mm SL), Norman R., Qld. Middle—GCRL 15717 (adult male, 132 mm SL), Gulf of Siam. Bottom—GCRL 17583 (adult male, 141 mm SL), Oyodo R., Honshu I., Japan.

PLATE 2

Upper Pair—*Parasyngnathus parvicarinatus*; Darwin, N.T.: Upper—WAM P.25801-001 (adult male, holotype, 78.5 mm SL). Lower—GCRL 15644 (adult female, paratype, 70 mm SL). Lower Pair—*Vanacampus vercoi.* AMS I.20193-006 (adult male, 101.5 mm SL), Kangaroo I., S.A.

PLATE 3

Upper Pair—*Vanacampus margaritifer*; Sydney, N.S.W. (GCRL 16454): Upper—adult male, 140.5 mm SL. Lower—adult female, 139.5 mm SL. Lower Pair—*V. phillipi*; Port Phillip Bay, Vic. (GCRL 16449): Upper—adult male, 113 mm SL. Lower—adult female, 118 mm SL.

PLATE 4

Top—*Vanacampus poecilolaemus*. GCRL 16267 (adult female, 194 mm SL), Garden I., W.A. Middle and bottom—*Pugnaso curtirostris*. AMS I.21643-004 (adult female, 145 mm SL), Westernport Bay, Vic.

PLATE 5

Kaupus costatus; Kangaroo I., S.A. Top—GCRL 16274 (adult female, 106 mm SL). Bottom—GCRL 16275 (adult male, 97 mm SL).

PLATE 6

Mitotichthys tuckeri; Swansea, Tas. (GCRL 17037): Top and middle—adult female, 150.5 mm SL. Bottom—adult male, 132 mm SL.

PLATE 7

Top and middle—*Mitotichthys semistriatus*; Port Phillip Bay, Vic.: Top—adult female, 175 mm SL (AMS I.19921-007). Middle—adult male, 145.5 mm SL (GCRL 17357). Bottom—*M. meraculus*. WAM P.25598 (adult female, 184 mm SL), East Flinders Bay, W.A.

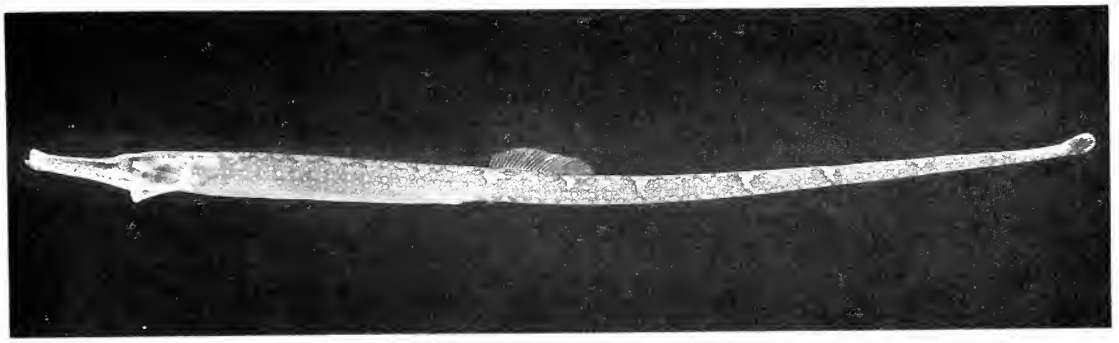
PLATE 8

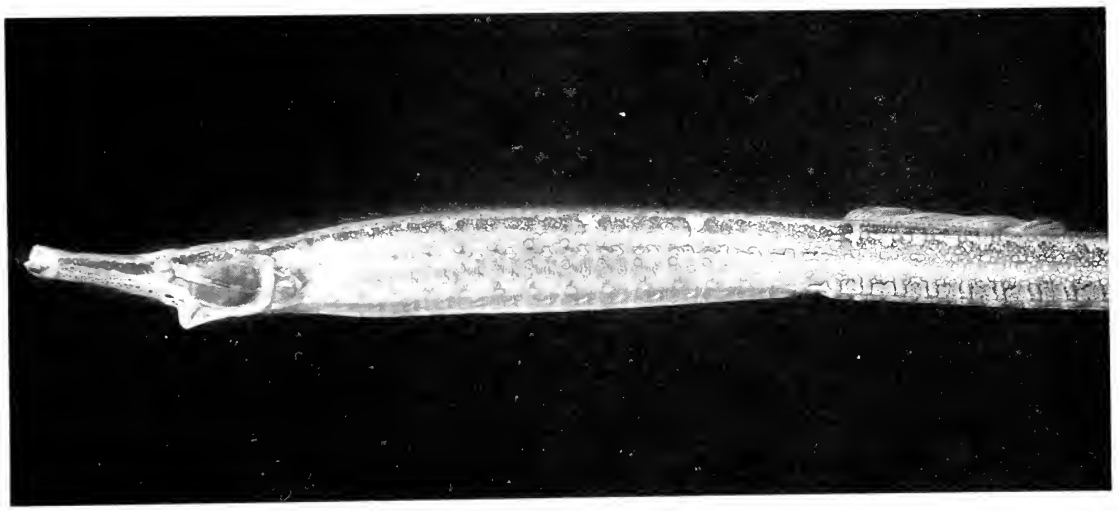
Histiogamphelus briggsii; Sydney, N.S.W. Top to bottom: Adult female (188 mm SL), adult female (184 mm SL), adult male (135 mm SL)—all CGRL 16338, and juvenile (36 mm SL), AMS I.18744-001.

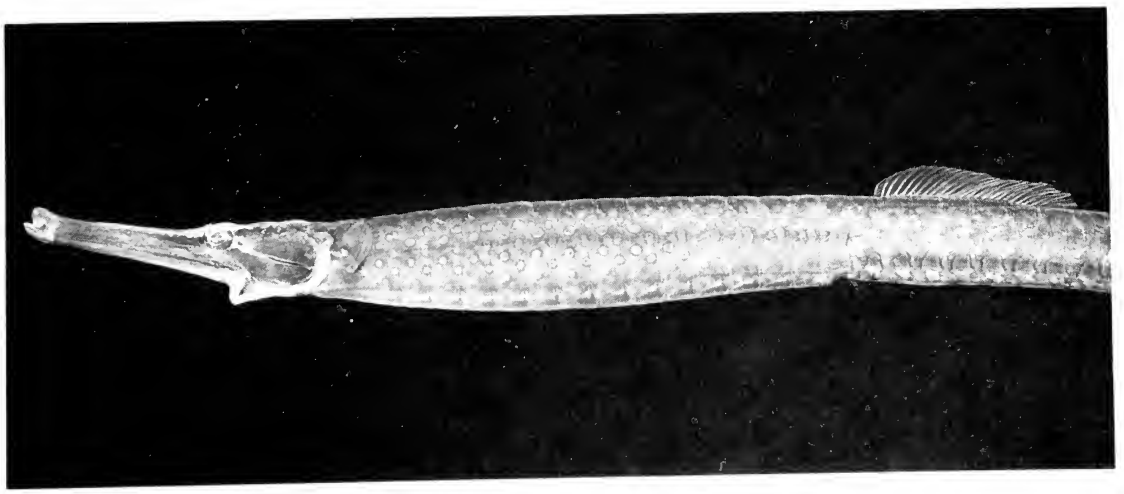
PLATE 9

Histiogamphelus cristatus. Top to bottom: WAM P.21008-018 (adult male, 133 mm SL), Geographe Bay, W.A.; AMS I.21008-018 (immature male, 158 mm SL), Kangaroo I., S.A.: WAM P.21062 (adult female, 161 mm SL), Geographe Bay, W.A.: WAM P.25767-004 (juvenile, 39 mm SL), Recherche Archipelago, W.A.

MEM. MUS. VICT. 45. PLATE I







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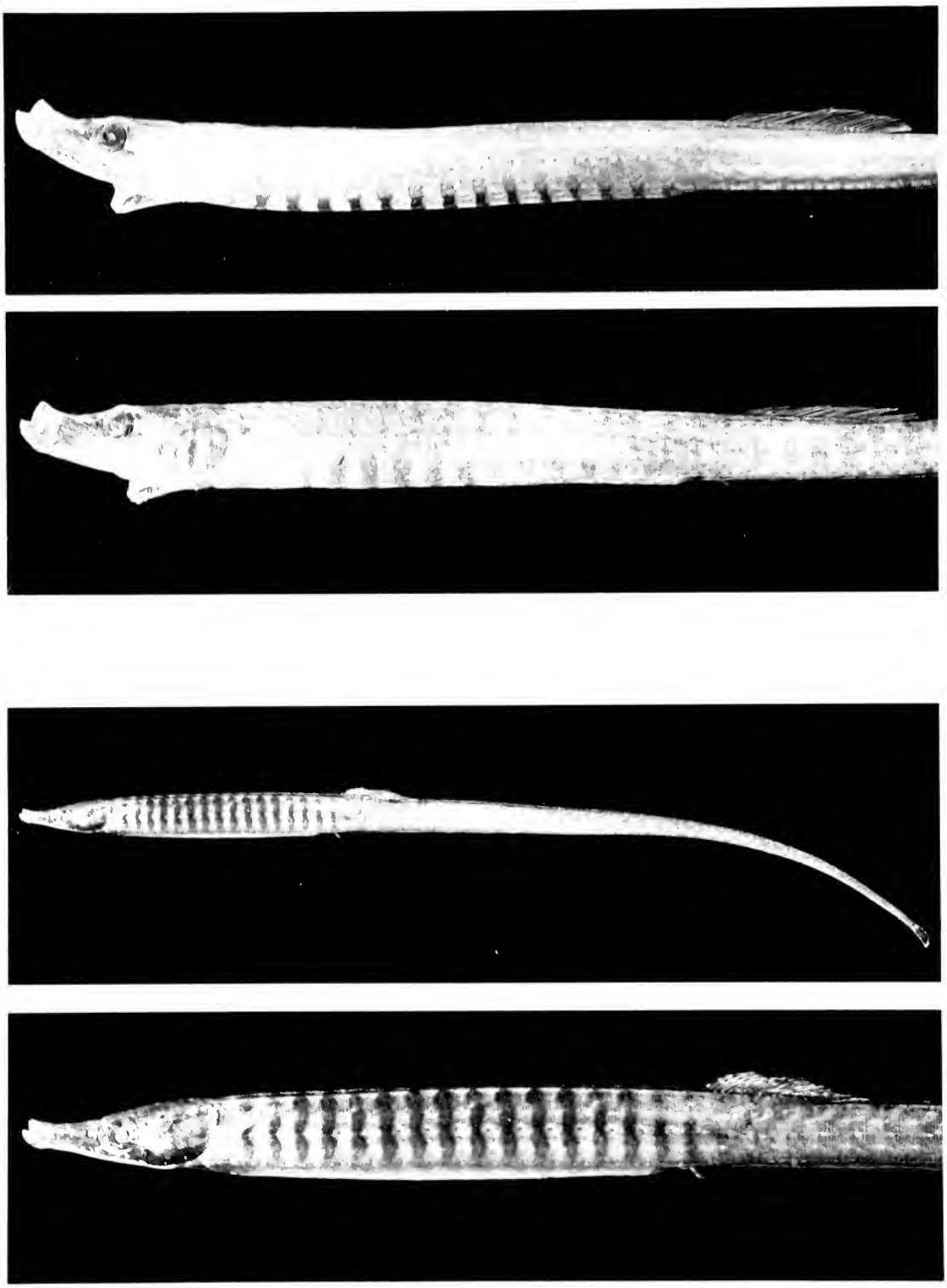
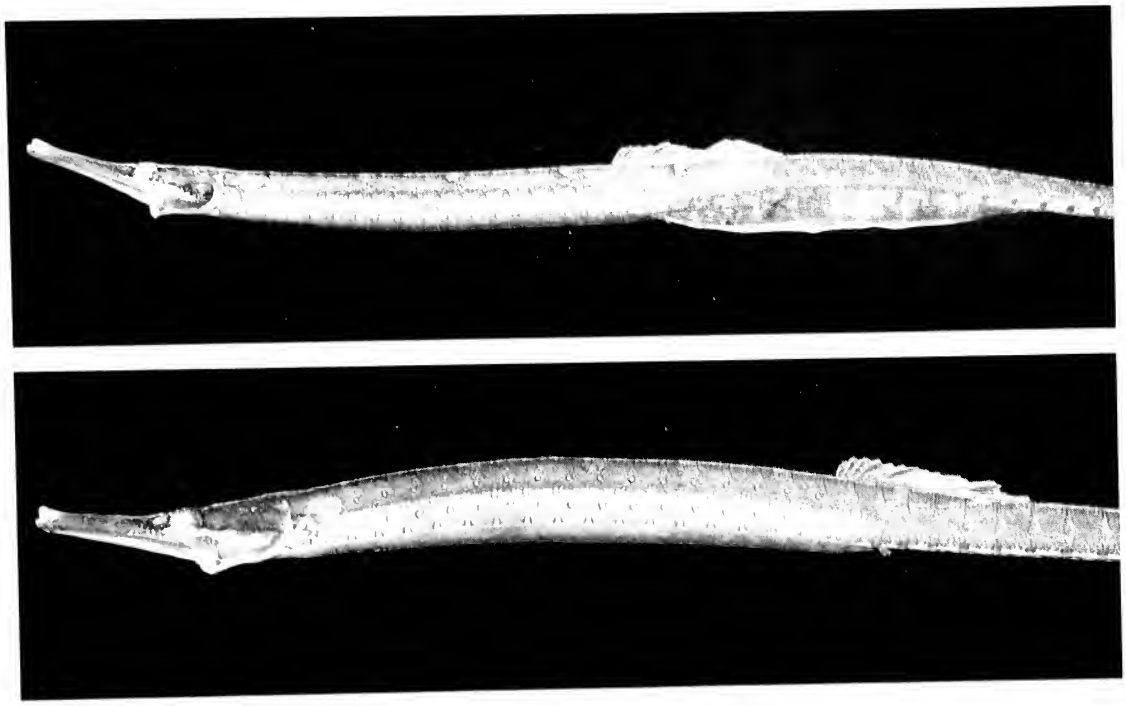
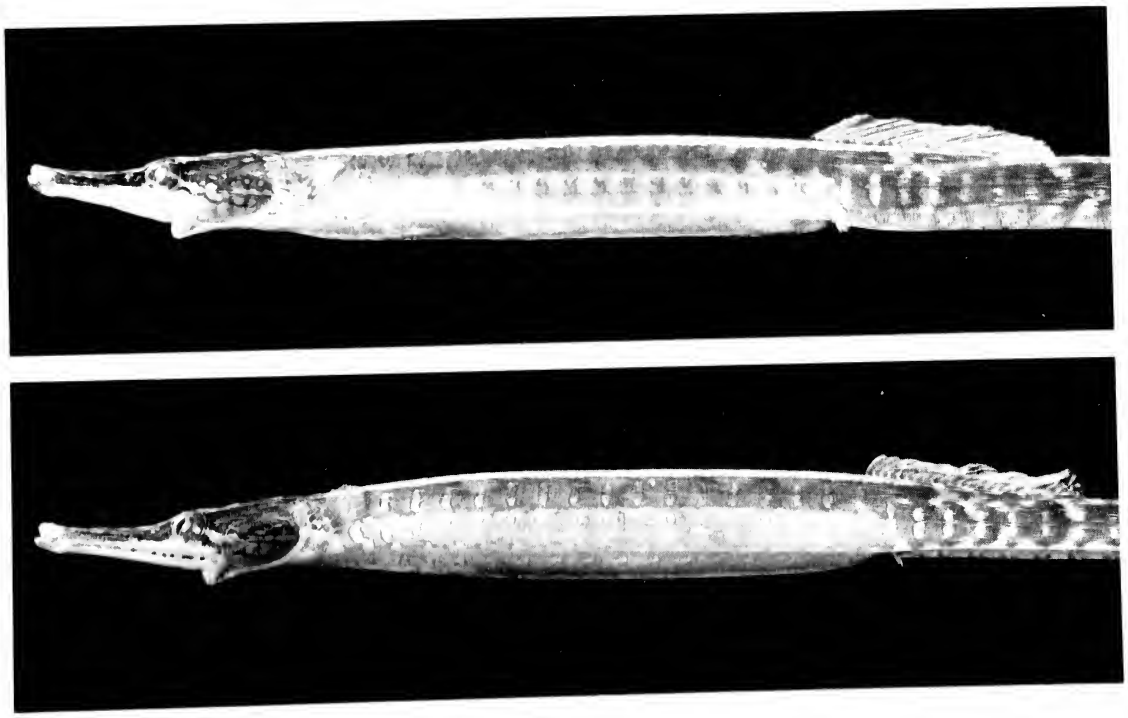
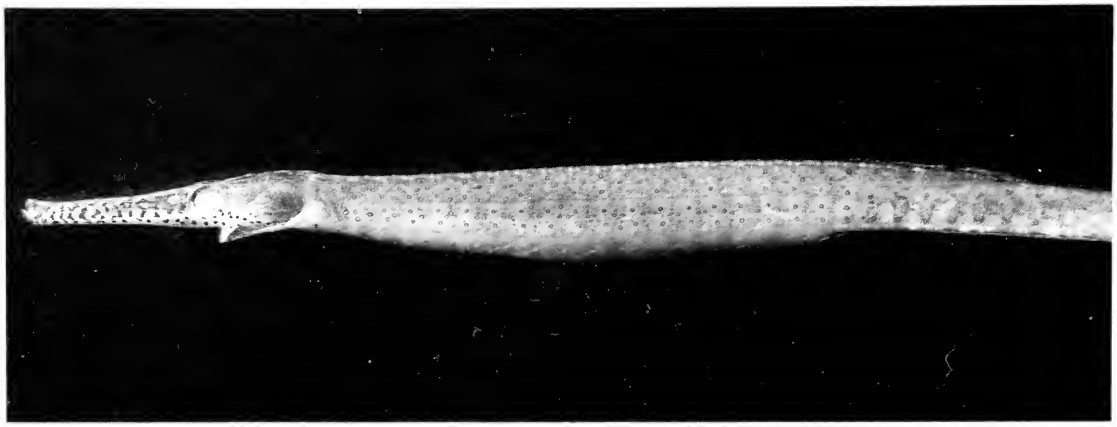
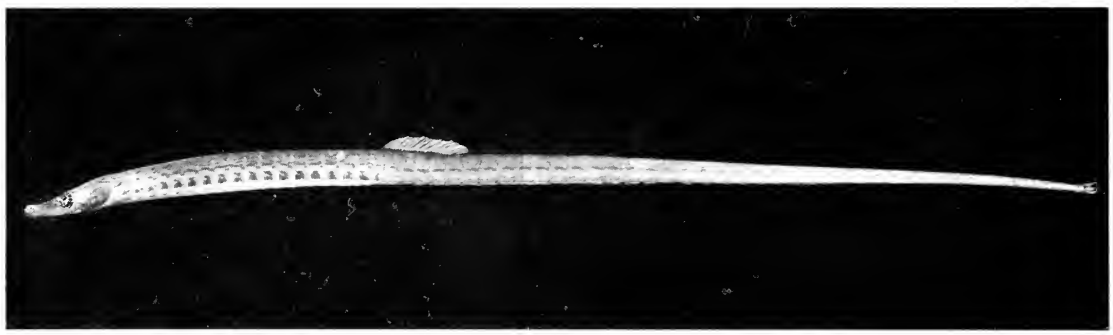


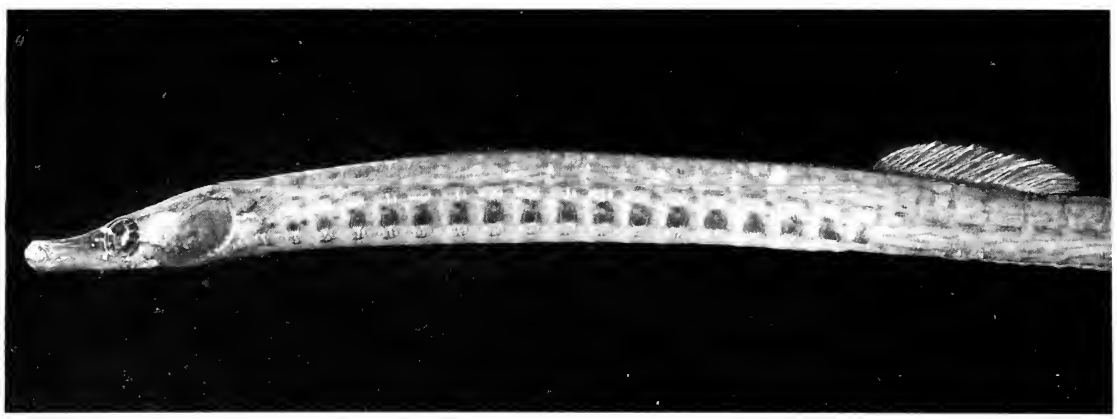


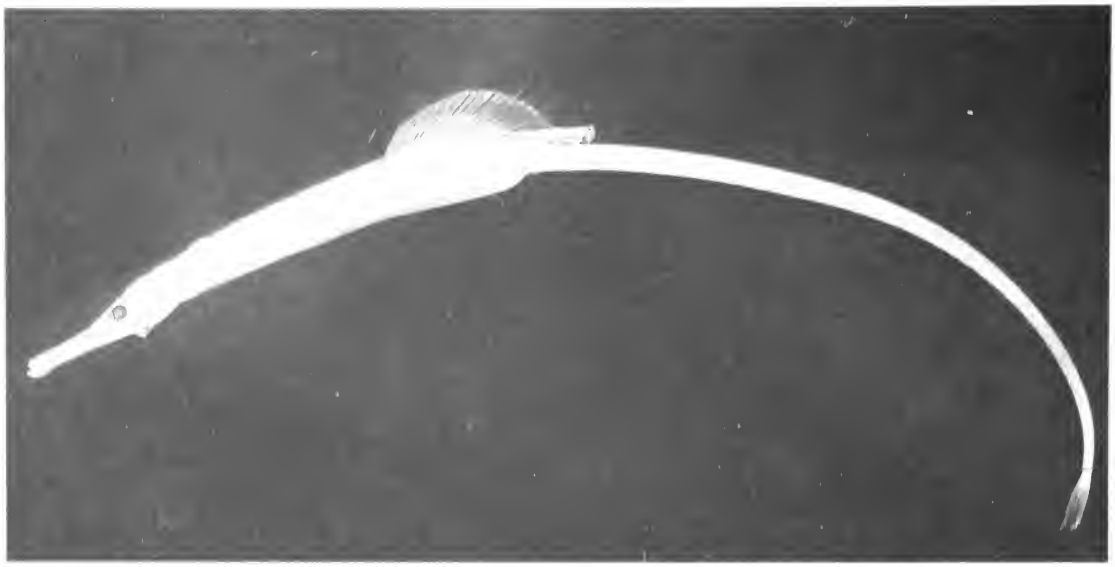


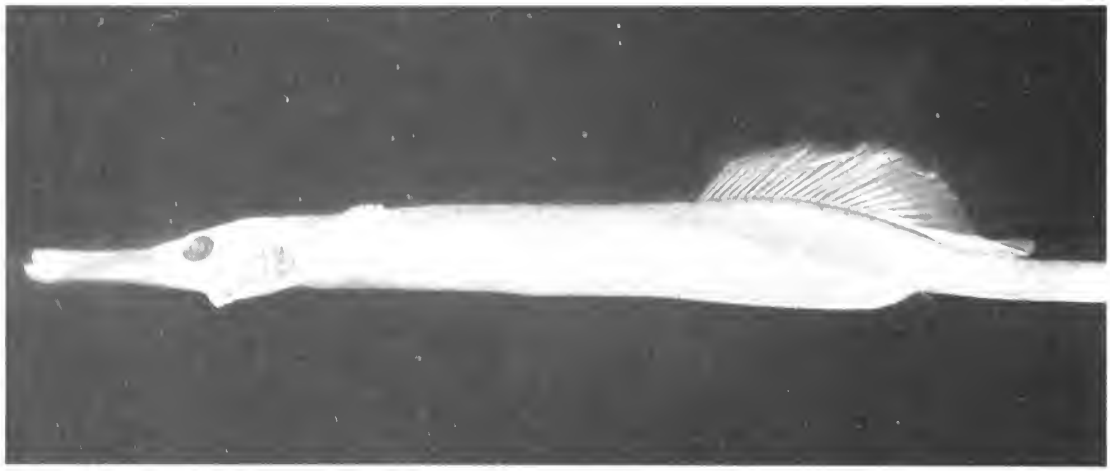
MEM. MUS. VICT. 45. PLATE 4

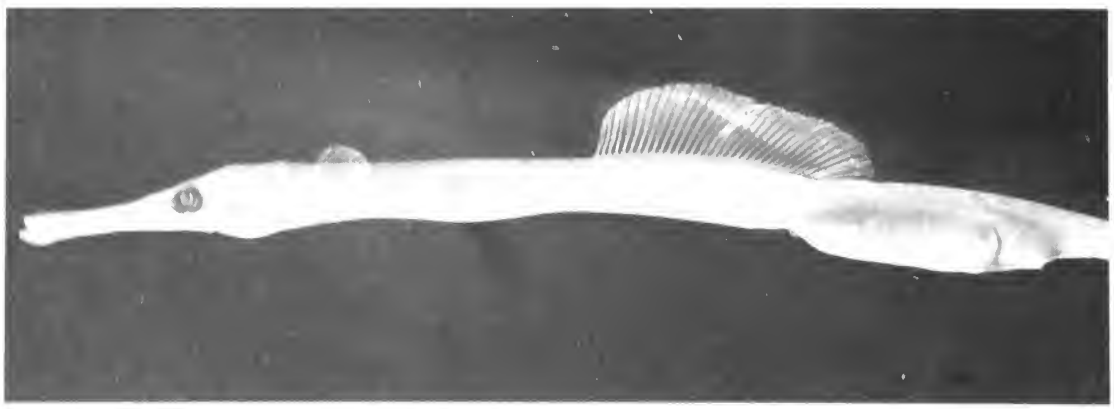












MEM. MUS. VICT. 18 PLATE 7